Flora of Oman

Volume 3

S.A. Ghazanfar

Scripta Botanica Belgica **55**

Cover illustration:
Centaurea pseudosinaica (Asteraceae); photo H. Pickering

Illustration page i:
Euryops arabicus (Asteraceae); drawn by S.A. Ghazanfar

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Shahina A. Ghazanfar

Flora
of the
Sultanate of Oman

Volume 3
Loganiaceae - Asteraceae

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Cover illustration: *Centaurea pseudosinaica* (Asteraceae); photo H. Pickering
Illustration page i: *Euryops arabicus* (Asteraceae); drawn by S.A. Ghazanfar

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Foreword

With biota varying from the coastal plains to the hills, from the desert to the Al Hajar mountains, there are some 1200 species of wild plants in the Sultanate of Oman. This Flora describes all these wild plants, and helps us to identify them; it teaches us their proper names, both scientific and local, and tells us where they grow. The continuing publication of this Flora with this third part (of four in total) is a real accomplishment of the author, Dr Shahina Ghazanfar; it is also an enormous step forward for the knowledge of wild plants in the Sultanate of Oman. And such knowledge is useful, not just in its own right, but also to any field that deals with plants and their uses; as one of the mottos of our organization, the Royal Botanic Gardens, Kew, says "All life depends on plants". Wild plants are so much more than just part of the landscape – they feed the wildlife, they buffer the rainfall in the hills and thereby regulate the streams coming from them, they are used in many ways by the people of the Sultanate; and they form a rich part of the people's traditions. Therefore this Flora contributes to both the preservation of a proud heritage, and as a help to the conservation of that heritage.

I was particularly pleased to be asked to write this Foreword, because I am passionate about Floras. I feel strongly that every country should have one, because a Flora makes communication about wild plants accessible; and thereby enables all further work based on, or dealing with, wild plants. During the preparation of a Flora the author is obliged to tackle many gaps in the knowledge about the wild plants of the area, as well, and such work throws up many surprises. Before the first Flora of a country is published, knowledge of its wild plant species is scattered and piecemeal; a good Flora pulls all such information together, adds to it, and forms the solid basis for any further work. And this is a good Flora: it has all the ingredients, and it is rigorously scientific as well as eminently practical.

As a Flora editor, I know how much work editing a Flora can be; as a Flora writer, I know how much time it can take to gather your data and translate it into something that is usable. To have both these functions rolled into one, and do all this work in addition to a host of other duties, is an accomplishment indeed! I commend Shahina Ghazanfar on her excellent work, and I commend this excellent Flora to all who work with, or are interested in, the plants of the Sultanate of Oman.

Henk Beentje
Editor Flora of Tropical East Africa &
former Head of Drylands Africa
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Contents

Foreword iii

Contents v

Acknowledgements vi

Preface vii

Abbreviations and Transliteration viii

Plant Families 1

69. Loganiaceae, 1
70. Gentianaceae, 1
71. Apocynaceae, 5
72. Solanaceae, 37
73. Convolvulaceae, 48
74. Cuscutaceae, 66
75. Boraginaceae, 67
76. Verbenaceae, 95
77. Avicenniaceae, 99
78. Lamiaceae, 100
79. Plantaginaceae, 127
80. Oleaceae, 130
81. Scrophulariaceae, 132
82. Orobanchaceae, 157
83. Acanthaceae, 161
84. Pedaliaceae, 182
85. Bignoniaceae, 183
86. Lentibulariaceae, 184
87. Campanulaceae, 186
88. Rubiaceae, 188
89. Caprifoliaceae, 198
90. Dipsacaceae, 200
91. Asteraceae, 201

Distribution Maps 279

Index of Latin and vernacular names 375

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Many colleagues and friends have given me their time, advice and help during the final production of this volume; I thank them all. In particular, I would like to mention Vasco Hexel of his help in acquiring QuarkXpress and Aljos Farjon for discussions on nomenclature. I am grateful to my sons, Tipu, Ali and Zomo for their continued support, and to Steve for his patience while putting this volume together.

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Preface

The third volume of the Flora of the Sultanate of Oman is the final one of the three volumes dealing with dicotyledons and includes 23 families and 376 taxa. Cronquist's (1981) system is used, but I have included explanatory notes where the APG III (2009) classification or recent molecular evidence treats the families or genera differently. This volume includes the Subclass Asteridae with the Oman flora represented in nine Orders: Gentianales, Solanales, Lamiales, Plantaginales, Scrophulariales, Campanulales, Rubiales, Dipsacales and Asterales. [In the APG III System: Euasterids I & II groups including the Orders Gentianales, Lamiales, Solanales, Dipsacales and Asterales]. For each species the format follows as for the other two volumes with the illustration number same as the number of the distribution map.

The accompanying CD-ROM contains images and illustrations of most of the species included in this volume. As for the other volumes, for the distribution maps a dot represents the presence of a taxon in a 25×25 km on a 100×100 km UTM grid on the map.

Accounts of the families Solanaceae and Rubiaceae have been done with Ghulam Sarwar, Karachi University, Pakistan, and that of Asteraceae co-authored with Norbert Kilian, Botanic Garden and Museum, Berlin-Dahlem, Friei University, Germany. Bert Jonkers has contributed substantially towards the account of the stapeliads in Apocynaceae.

Since the submission of the manuscript for this volume, several new records of species have been added to the flora of Oman. To avoid re-formatting of the entire manuscript, these have been added as 'New Records for Oman' at the end of relevant families.

Shahina A. Ghazanfar
Royal Botanic Gardens, Kew
June 2015

Abbreviations and Transliteration

Standard botanical abbreviations of Latin words used in text are listed below.

aff.	affinis: akin to
auct.	auctorum: of authors
c.	circa: about
in sched.	in schedula: on herbarium label or sheet
loc. cit.	loco citato: on the page previously cited
nom.	nomen: name
nom. conserv.	nomen conservandum: conserved name
nom. illegit.	nomen illegitimum: illegitimate name
nom. nud.	nomen nudum: name unaccompanied by a description
n.v.	non vidi: not seen
op. cit.	opere citato: in the work previously cited
p.p.	pro parte: in part
s.n.	sine numero: without number
s.l.	sensu lato: in a broad sense
s.str.	sensu stricto: in the strict sense

Arabic, Harsusi and Jibbali names are transliterated using the BGN/PCGN 1956 System (US Board on Geographical Names and the Permanent Committee on Geographical Names for British Official Use).

	Arabic	Romanization		Arabic	Romanization
Alif	ا	a	Dad	ض	d,
Ba	ب	b	ta	ط	t
Ta	ت	t	Za	ظ	z
Tha	ث	th	‘Ayn	ع	‘
Jim	ج	j	Ghayn	غ	gh
Ha	ح	h,	Fa	ف	f
Kha	خ	kh	Qaf	ق	q
Da	د	d	Kaf	ك	k
Dha	ذ	dh	Lam	ل	l
Ra	ر	r	Mim	م	m
Za	ز	z	Nān	ن	n
Sin	س	s	Ha	ه	h
Shin	ش	sh	Waw	و	w
Sad	ص	S	Ya	ى	y

69. **Loganiaceae**

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Mitreola L.

Six species with one widely distributed; W Africa, SW Arabia, NE India, S China to Australia, SE USA to Peru and Brazil.

Mitreola petiolata (J.F.Gmel.) Torr. & Gray, Fl. N. Amer. 2: 45 (1841).

Basionym: *Cynoctonum petiolatum* J.F.Gmel. (1791) based on *Anonymos petiolata* Walt. (1788). *Synonym*: *Cynoctonum mitreola* (L.) Britton (1894).

Description: Perennial herb, 5–20 cm. Stems erect, simple or branched, quadrangular to narrowly winged, glabrous. Stipules ± 1 mm, broadly triangular. Leaves opposite, 10–55 × 5–35 mm, ovate to elliptic, base tapering into a long petiole 5–20 mm, apex acute to obtuse, margins entire, glabrous to sparsely appressed pubescent, ciliate. Inflorescence terminating the stems, dichasial, widely branched; pedicels up to 3 cm; bracts 1.5–3 mm, narrowly triangular. Calyx 5-lobed, united to about a fifth of their length, ± 2 mm; lobes ± 1 mm, ovate to triangular, glabrous. Corolla white to bluish, 1.5–2.5 mm, lobed above; lobes ± 1 mm, triangular. Stamens 5, inserted at the base of the corolla; anthers yellow. Ovary subglobose, slightly compressed. Capsule 2–3 mm, 2-horned, the horns divergent, erect, or curved inwards, adpressed-pubescent.

Flowering & Fruiting: August to October.

Distribution: Southern Oman, Dhofar, on the escarpment mountains, in grassland, in shade in moist places; not common. *Altitude*: 350–500 m. Distributed in West tropical Africa, tropical America, SE USA, SW Arabia, NE India, S China to Australia. Elsewhere in the Arabian Peninsula found in Yemen (S).

Distribution Map & Illustration: 535.

Cultivated species

Strychnos nux-vomica L. has been cultivated in private homes in Dhofar for the seeds that have been used in traditional medicine.

70. **Gentianaceae**

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Thulin, M. (2001). *Exacum* (Gentianaceae) on the Arabian Peninsula and Soqotra. *Nord. J. Bot.* 21: 243–247.

Key to the genera of Gentianaceae in Oman

1. Flowers sessile, white, in axillary clusters ..... 2. **Enicostemma**
   Flowers pedicellate, blue, purplish or pink, terminal, solitary or in axillary cymes . 2
2. Flowers 4-merous; staminodes 1–2; calyx lobes with the wing hyaline and distinctly veined, veins yellowish, thick ..... 3. **Canscora**
   Flowers 5-merous; calyx lobes with wing not hyaline 3
3. Flowers bright pink, > 10 mm; anthers twisting after shedding pollen ..... 4. **Centaurium**
   Flowers blue to purplish, < 10 mm; anthers not twisting after shedding pollen ..... 1. **Exacum**

1. **Exacum** L.

About 65 species distributed from the Arabian Peninsula to tropical Africa south to South Africa and Madagascar, India, S China through tropical Asia to Australia.

Calyx wing rounded, 3–4 mm wide; anthers 2.5–4 mm, curved; style longer than the stamens ..... 1. **E. affine**
Calyx wing oblong, 0.5–1 mm wide; anthers ± 1 mm, straight; style ± as long as the stamens ..... 2. **E. arabicum**

1. ***Exacum affine*** Balf. f. ex Regel, Gartenfl. 34. t. 1108 (1883).

Synonym: *Exacum gracilipes* Balf. (1884). Type from Soqotra, material grown from seed collected by Schweinfurth on Soqotra in 1881, "ex horto Haage und Schmidt" (syntypes LE, K).

Description: Perennial or an annual herb, semi-succulent, 5–15 cm. Stems erect, simple or sparsely branched (in Oman) weak, somewhat quadrangular and winged, glabrous. Leaves opposite, bright green, 10–35 × 5–25 mm, broadly ovate to ovate to elliptic, acute, entire, base tapering into a long petiole 7–15 mm, lamina distinctly 3(–5)-nerved, glabrous. Flowers solitary or in terminal or axillary cymes; pedicels up to 4 cm; bracts 2–3 mm, lanceolate. Calyx 5-lobed, lobes united to about a fifth of their length, 4–6 mm, lanceolate, acuminate, with the wing 3–4 mm, rounded. Corolla blue to purplish blue, 8–11 mm, lobed above; lobes oblong. Stamens 5; anthers yellow, 2.5–4 mm, curved; style longer than the stamens. Capsule about as long as the calyx, mucronate with the persistent style. Seeds muricate.

Flowering & Fruiting: August to September.

Distribution: Southern and Central Oman, and Dhofar, on cliffs and rock crevices, in salty seepages, and places with dripping water. *Altitude*: 50–100 m. Not found elsewhere in the Arabian Peninsula, but found commonly on Soqotra (Miller & Morris, Ethnoflora of the Soqotra Archipelago: 570, illustr. 264).

Distribution Map & Illustration: 536.

Notes: A variable species which has been earlier recognised as two species, *E. affine* and *E. gracilipes* (Klackenberg, 1985, cited above; Ghazanfar, Ann. Cat. Vasc. Pl. Oman 1992: 76), but the latter is believed to be a "slender form of *E. affine*" (Thulin 2001, cited above).

2. ***Exacum arabicum*** Thulin, Nord. J. Bot. 21: 245 (2001).
Type: Yemen, Mahra region, Ras Fartaq, *Thulin, Beier & Mohammed A. Hussein* 9590 (holotype UPS; isotype K).

Description: Delicate annual herb, up to 10 cm. Stems simple or branched, weak, somewhat succulent and quadrangular, with slightly winged edges, glabrous. Leaves opposite, bright green, 3–25 × 3–15 mm, elliptic to elliptic-ovate, to suborbicular, base tapering into a short petiole, apex acute to rounded, margins entire, 3(–5)-nerved, glabrous. Flowers solitary or in terminal or axillary cymes; pedicels up to 20 mm, slender. Calyx 5-lobed, pale green with dark green wings, lobes united to about a fifth of their length; lobes 3–4 mm, lanceolate, acuminate, with narrow wings 0.5–1 mm. Corolla blue to purplish-blue, 5–7 mm, lobed above; lobes oblong, acute or rounded above. Stamens 5; anthers yellow, ± 1 mm, straight; style ± as long as the stamens. Capsule about as long as the calyx, mucronate with the persistent style. Seeds muricate.

Flowering & Fruiting: August to September.

Distribution: Southern Oman, Dhofar, on moist cliffs, in thickets in the escarpment woodland, on moist and shaded cliffs, in thick grass on moist wadi banks. *Altitude*: 50–500 m. A regional endemic, elsewhere in the Arabian Peninsula found in the Mahra region of S Yemen.

Distribution Map & Illustration: 537.

2. **Enicostema** Blume
Three species distributed from tropical Africa to South Africa and Madagascar; India, S China through tropical Asia to Australia.

Enicostema axillare (Lam.) A.Raynal, Adansonia ser. 2, 9: 75, t. 2, fig 1–2 (1969).
Basionym: *Gentiana axillaris* Poir. ex Lam. (1793). Type: Yemen, *Forsskål* 239 (holotype C; microf. 125: II. 5, 6).

Description: Perennial herb, somewhat glaucous, up to 30 cm or more. Stems branched from the base, ascending to decumbent to ± erect, glabrous, leafy throughout. Leaves opposite, sessile, 18–50 × 5–10 mm, lanceolate to narrow elliptic to linear, acute, entire to minutely denticulate, base cuneate, 3-nerved, glabrous. Flowers in congested axillary clusters, sessile; bracts lanceolate, green with hyaline margins. Calyx 5-lobed to almost the base, 3–4 mm, lobes ± equal, oblong, acute, with yellowish hyaline margins. Corolla white, tubular, ± 18 mm, lobes ± 3 mm, oblong, acute. Stamens 5, filaments inserted on the corolla tube. Capsule obovoid. Seeds muricate.

Flowering & Fruiting: August to September.

Distribution: Southern Oman, Dhofar, in woodland, in moist and shaded locations. *Altitude*: 0–200 m. Distributed in tropical Africa and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution Map & Illustration: 538.

3. **Canscora** Lam.

Thirty species distributed in tropical Africa and Madagascar, India, S China to N Australia.

Canscora concanensis C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 104 (1883).

Description: Delicate annual herb, up to 20 cm or more. Stems erect to ascending, yellow green, simple or dichotomously branched, somewhat 4-angled, glabrous. Leaves opposite, 10–25 × 5–14 mm, ovate to ovate-elliptic, acute, entire, base tapering into a short winged petiole or leaves sessile, distinctly 3(–5)-nerved, glabrous. Flowers 4-merous, in terminal or axillary cymes; bracts 2–3 mm, linear, perfoliate; pedicels and peduncles slender. Calyx 6–7 mm, lobes lanceolate, winged, the wing hyaline and distinctly veined, veins yellowish, thick. Corolla bright pink, ± 8 mm, 5-lobed above into 5 lobes, lobes along. Stamens with 1–2 staminodes. Capsule ovate.

Flowering & Fruiting: August to September.

Distribution: Southern Oman, Dhofar, in *Anogeissus* woodland, in moist and shaded locations. *Altitude*: 400–650 m. Distributed in India in the Western Ghats (Maharashtra Province). Not found elsewhere in the Arabian Peninsula.

Distribution Map & Illustration: 539.

4. **Centaurium** Hill.

Thirty species distributed in the north temperate regions south to Cape Verde Islands, Somalia, Australia, Chile and Argentina.

Centaurium pulchellum (Sw.) Druce, Fl. Berks. 342 (1897), annotated as "*Centaurion*". *Basionym*: *Gentiana pulchella* Sw. (1783); *Synonym*: *Erythraea ramosissima* (Vill.) Pers. (1805).

Description: Annual herb, up to 20 cm (there is taller and robust material from Bahrain and Saudi Arabia). Stems erect to ascending, simple or branched, branching dichotomously, winged, glabrous. Leaves opposite, sessile, 5–25 × 3–10 mm, elliptic to oblong-elliptic, acute, entire, 3-nerved, glabrous. Flowers 5-merous, in terminal or axillary cymes. Pedicel ± 2 mm; bracts similar to leaves but smaller. Calyx 6–9 mm, tubular, tube shorter than the lobes, lobes 5–8 mm, lanceolate, unequal, winged at the back, wing membranous, narrow, green. Corolla bright-pink, ± 14 mm, tubular; tube 10–11 mm, white, divided above into 5 pink lobes ± 3 mm. Stamens 5, filaments inserted in about the middle of the corolla tube. Capsule oblong. Seeds globose.

Flowering & Fruiting: August to September.

Distribution: Northern Oman, including Musandam, on the western Hajar mountains, in fallow fields, wadis, in sandy depressions and shaded locations; in Southern Oman, Dhofar on low hill slopes and gullies. *Altitude*: 700–1500 m. Distributed C & W Europe through the Mediterranean region, Turkey to India, N & NE Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution Map & Illustration: 540.

Notes: Collected by Aucher-Eloy as *Centaurium erythraea* Rafn.: "regn. Mascate" 4961, 4956 (P).

71. **Apocynaceae**

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Apocynaceae now includes the families Asclepiadaceae and Periplocaceae which, until recently were recognized as separate families. Recent molecular studies and morphology show both families as specialised members of the family Apocynaceae. The infrafamilial classification of the larger Apocynaceae recognizes 5 subfamilies: Rauvolfioideae, Apocynoideae, Periplocoideae, Secamonoideae and Asclepiadoideae. Representative species of three of these subfamilies occur in Oman.

The family is here taken in the wide sense, including Asclepiadaceae and Periplocaceae. Genera 1–4 are referred to subfamily Apocynoideae, genera 5–6 to subfamily Periplocoideae, and genera 7–20 to subfamily Asclepiadoideae.

The subfamily Asclepiadoideae have a unique floral structure where the 5 stamens are fused apically to the expanded stigma to form the gynostegium. The filaments are fused together to form the staminal column where the ovary is concealed. The filaments are free in the subfamily Periplocoideae. The corona is present inside the corolla lobes, it may be derived from the corolla lobes or from the staminal column. The corolline corona occurs either in the sinus of the corolla lobes or form an annulus in the corolla tube. The gynostegial corona is attached to the stamens and an interstaminal corona, both of which can be combined in various ways are diagnostic in recognising genera and species.

In recent years the circumscription of *Caralluma* has taken frequent changes. Bruyns et al. (2010) show that the stapeliads consist of two lineages, with *Caralluma* dominating one of these lineages. They show that within this lineage, *Caralluma* is not monophyletic, and its species are distributed among two major clades. One of these clades contains species of *Caralluma* and representatives of *Anomalluma* Plowes, *Echidnopsis* Hook. f. and *Rhytidocaulon* P.R.O. Bally, while in the other clade the small genera *Edithcolea* N.E. Br., *Frerea* Dalz. and *Pseudolithos* P.R.O. Bally are embedded among species of *Caralluma*.

Here I follow the treatment of Meve & Liede (2002) based on their analysis of *Caralluma* s.l. at molecular level. They classify the 57 species accepted in *Caralluma* sensu Gilbert (1990) in 7 distinct genera which are closely related and represent the North African Arabian Indian group of taxa. I have added some comments by H.A. Jonkers who has collected, photographed and worked on *Caralluma* s.l. and other succulents in Oman.

Key to the subfamilies of Apocynaceae

1. Gynostegium absent; coronal structure absent; anthers with usually sterile basal portions and lignified margins; pollen shed as monads ..... Apocynoideae
   Gynostegium present; coronal structure present; pollen shed as tetrads or aggregated into pollinia (2 per locule) 2
2. Staminal filaments not fused together to form a tube; anther margins not lignified ..... Periplocoideae
   Staminal filaments fused to form a tube; anther margins lignified; pollen aggregated into pollinia (1 per locule) ..... Asclepiadoideae

Key the genera of Apocynaceae in Oman

1. Gynostegium and coronal structure absent 2
   Gynostegium and coronal structure present 5
2. Armed shrub with simple or forked rigid spines; fruit a globose fleshy berry ..... 4. **Carissa**
   Unarmed shrubs; fruit single or paired elongated follicles 3
3. Leaves in whorls of 3(–5), lanceolate; fruit 15–20 cm long, longitudinally ribbed, valves reflexed when split ..... 3. **Nerium**
   Leaves alternate; fruit of paired follicles 4
4. Base of stem not swollen; flowers white; stamens without terminal appendages; fruit paired, erect; seeds compressed, surrounded with a narrow pale-brown wing ..... 2. **Rhazya**
   Base of stem swollen; flowers pink; stamens with long hispid terminal appendages; fruit paired, not erect; seeds with tuft of hairs at each end ..... 1. **Adenium**
5. Staminal filaments free 6
   Staminal filaments fused 7
6. Leaves typically 4, appearing together opposite each other, later becoming opposite as the stem elongates; corona lobes 4–6 mm, linear-oblong, cohering at the top; stamens glabrous ..... 6. **Raphionacme**
   Leaves opposite, falling soon; corona 3-segmented, central filiform, 3–4 mm long, lateral fleshy, ovoid; stamens hairy ..... 5. **Periploca**

7. Leaves well developed (sometimes falling soon, stems appearing leafless) 8
Leaves absent, or if present falling soon, and stems succulent, or leaves reduced to scales 15
8. Corolla tube with a distinct globose basal swelling; corolla lobes attached at the tips forming a "cage"-like structure ..... 16. **Ceropegia**
Corolla tube without a distinct globose basal swelling; corolla lobes not attached at the tips 9
9. Shrubs with weak twining, prostrate or scrambling stems 10
Shrubs with stems erect, never weak and twining 12
10. Latex milky; flowers in pedunculate, axillary cymes; follicles generally paired, covered with soft spines, tubercles or soft bristles ..... 11. **Pergularia**
Latex clear; flowers in axillary clusters; follicles generally single, smooth and glabrous 11
11. Leaves herbaceous, not fleshy; corolla green with dark purple spots, lobed to half its length, lobes not spiralling at ends ..... 7. **Cibirhiza**
Leaves thick and often fleshy; corolla yellowish green, lobed almost to base, lobes spiralling at ends ..... 12. **Pentatropis**
12. Leaves opposite and decussate, grey-green, with mealy, lanate surfaces; corolla lobes white outside, purple inside; corona purple ..... 9. **Calotropis**
Leaves opposite, not decussate, pubescent or glabrous; corolla lobes and corona white or yellow 13
13. Large leafless shrubs up to 3 m (leaves falling soon); latex clear; follicles fusiform with a long beak, smooth and glabrous, not inflated ..... 15. **Leptadenia**
Shrubs up to 1.5 m, leafy; latex white; follicles ± inflated, covered with soft spines or hairs 14
14. Inflorescences forming pedunculate nodding umbels; coralline corona absent; follicles with soft hairs (in our plants) ..... 10. **Gomphocarpus**
Inflorescences of sessile umbels; coralline corona present; follicles with soft spines that harden later ..... 8. **Glossonema**
15. Large leafless shrubs up to 3 m (leaves falling soon, visible on young shoots); stems erect ..... 5. **Leptadenia**
Shrubs with scrambling or ± twining stems or low herbaceous shrubs up to 50 cm with succulent or fleshy stems 16
16. Stems cylindrical, articulated at the nodes, thick but not succulent, smooth 17
Stems fleshy and succulent, angular or with tubercle-like structures 18
17. Stems smooth; flowers with corolla lobes erect; corona double, the outer 2-lobed, cup-like, the inner with staminal lobes hood-shaped attached to the central column ..... 14. **Sarcostemma**
Stems striate; flowers with corolla lobes reflexed; corona of 5 cup-like lobes; without hooded staminal lobes ..... 13. **Cynanchum**

18. Stem unbranched, rounded in cross section, covered with rounded tubercles rooting at the base where it comes in contact with the ground; flowers yellow, borne on the stem ..... 21. **Echidnopsis**
Stems usually branching from base, 4–5-angled in cross section, smooth or covered with rounded teeth, tubercles or soft spines at angles 19
19. Flowers in umbels, apical or subapical on stem ..... 18. **Desmidorchis**
Flowers 1–several, apical or axillary, not forming umbels 20
20. Flowers 1–4, forming false racemes along elongated apical stem portions ..... 17. **Caudanthera**
Apical stem portions rounded or tapering, not elongated 21
21. Stems with soft spines on the angles of stems; corolla lobes linear, revolute ..... 23. **Orbea**
Stems with rounded teeth or tubercles on the angles; corolla lobes oblong or triangular, not linear 22
22. Stems wrinkled and bullate, grey-green, prostrate, creeping to ± ascending; corolla lobes connivent at their tips (*R. fulleri*) ..... 20. **Rhytidocaulon**
Stems smooth, mostly green, erect to ascending; corolla lobes spreading to ± erect ... 23
23. Stems conspicuously tessellate; corolla dark greenish-purple or dark olive-green with purple-brown spots, <10 mm across (in our plants) ..... 22. **Anomalluma**
Stems not tessellate; corolla yellow or yellow-green with dark purple papillae in streaks and spots ..... 19. **Monolluma**

Subfamily **Apocynoideae**

1. **Adenium** Roem. & Schult.

Five species, distributed from SW Arabia, tropical Africa to South Africa.

Adenium obesum (Forssk.) Roem. & Schult., Syst. Veg. 4(35): 411 (1819).
Synonym: *Nerium obesum* Forssk. (1775). Type: Yemen, Melham, *Forsskål* 235 (holotype C).
Vernacular names: adan, adana, seyfid (Dhofari Arabic).

Description: Succulent shrub, up to 2 m. Stem swollen at the base sometimes up to 2 m across, sparsely branched, bark grey, smooth, branches ascending. Latex clear or white. Leaves alternate, sessile, clustered at the ends of branches, 5–12(–17) × 1–5 cm, obovate, base cuneate, apex emarginate or acute or mucronate, margins entire, glabrous or pubescent, green above, pale green or reddish tinged beneath; midrib prominent beneath. Flowers pink to reddish-pink, tinged yellowish in throat, in few-flowered cymes, present at the tips of branches. Calyx 5–10 mm, tubular, 5-lobed to half its length; lobes ± 4 mm, acute, ciliate. Corolla 2–4 cm, funnel-shaped, 5-lobed above, with small coronal scales at the base of the lobes and alternating with them, pubescent except for the lobes which are glabrous on the inside; lobes 10–13 mm, broadly ovate, mucronate at apex. Stamens 4, each with long hispid terminal appendages. Fruit of 2 elongated follicles, up to 10 cm, fused at the base, dark red-brown. Seeds with a tuft of brown hairs at each end.

Flowering & fruiting: August to October but also flowering sporadically; fruit maturing in October.

Distribution and habitat: Southern Oman, Dhofar, in low dry rocky hills in the foot of the escarpment mountains reaching to the sea and also in the drier north-facing slopes of the mountains. *Altitude*: 30–850 m. Distributed in tropical East Africa and from Senegal to Sudan, Ethiopia and Somalia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 541.

Notes: The plant has been used in traditional medicine for treating bone dislocations, painful joints, sprains, paralysis, swellings, wounds and skin infections. Certain folklore is attached to this plant in southern Oman where it is believed that snakes obtain their poison from it. The sap is used to protect against evil eye and spirits.

2. **Rhazya** Decne.
A single species distributed in the Arabian Peninsula, and from Iraq to W India.

Rhazya stricta Decne., Ann. Sci. Nat., Bot. sér. 2, 4: 80 (1835).
Vernacular names: harmal; adfir (Jibbali).

Description: Perennial herb, 30–70 cm, often the base of the stems woody and covered with bases and scars of old leaves. Leaves alternate, 5–7 × 1–3 cm, narrowly ovate to lanceolate, base unequally attenuate into a short petiole < 1 mm, apex acute, coriaceous, fresh green in colour, yellowish-green when dry, glabrous; midrib yellowish and raised on the undersurface. Flowers white, in terminal corymbose clusters, arising in the axils of the leaves. Calyx tubular with 5 triangular lobes 2 mm long, glabrous. Corolla tubular, widest at throat, 5-lobed above, the lobes spreading; tube 8–14 mm, hairy inside; lobes bluish-green outside, 3–6 mm long, acute. Fruit cylindrical, paired, erect, 5–8 cm, green when young, brown and dry when mature, splitting at maturity. Seeds compressed, brown, surrounded with a narrow pale brown wing.

Flowering & fruiting: February to April; fruits mature by May.

Distribution and habitat: Throughout Oman, in the foothills and wadis, wadi banks, and sandy and gravel plains, at edges of sandy plains, often forming the dominant part of vegetation with *Tetraena* (*Zygophyllum*) and *Fagonia indica*. *Altitude*: 50–600 m. Distributed throughout Arabia, extending from southern Iran, Iraq, Afghanistan, Pakistan to NW India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 542.

Notes: In Yemen and Saudi Arabia, the name *harmal* is used for *Peganum harmala*, an important medicinal plant. In Oman this name is given to *Rhazya stricta*. This is one of the most commonly used and important plant in traditional medicine, especially against diabetes. In Dhofar (southern Oman) it was collected and sold by the people living in the desert

areas to the mountain dwellers and also to the sea traders on the coast. It was regarded highly for both its medicinal and supernatural powers. The whole plant including the seeds have been used for improving bad breath, chest pain, conjunctivis, constipation, and diabetes; it was also used for lowering fevers, soothing skin rash, as an anthelmintic, and to increase lactation. Indian sunbirds have been recorded to feed from the flowers.

The genus *Rhazya* is named after Muhammed ibn Zakariya Al-Razi, a renowned 11th century Arab physician who also discovered the infectious nature of smallpox and measles.

3. **Nerium** L.

A single species distributed from Macaronesia to Japan; widely cultivated and naturalised throughout the tropics.

Nerium oleander L., Sp. Pl. 1: 209 (1753).
Synonyms: *Nerium odorum* Soland. (1789); *N. mascatense* A.DC. (1844).
Vernacular name: habān.

Description: Evergreen shrub, up to 3 m. Stems branched, with a milky latex. Leaves glossy, opposite, leathery, in whorls of 3–5; lamina 10–11 × 2–2.5 cm, lanceolate, base cuneate, apex acute, margins entire, glabrous; stipules absent. Flowers somewhat fragrant, pink, ± 3 cm across, in terminal cymes; pedicels 3–4 mm. Calyx 7–8 mm, 5-lobed to 3/4 its length; lobes lanceolate, 5–6 mm, margins ± hyaline and pale green, pubescent. Corolla funnel-shaped, widest at throat, 5-lobed above, the lobes ± spreading; tube cylindrical, 5–7 mm, lobes 15 × 20 mm, obovate, with an apiculate or acute tip. Stamens 5; filaments short, included. Fruit an elongated thick syncarpous follicle, 15–20 cm long, ± 2 cm in diameter, longitudinally ribbed, green, ripening brown, valves reflexed when split. Seeds with brown plumose at tip.

Flowering and fruiting: September to March, but at other times of the year as well.

Distribution and habitat: Throughout Oman, in the lower altitudes of the mountains and in wadis, often near water. Also cultivated throughout Oman as roadside shrub. *Altitude*: 0–1800 m. Distributed from northern Africa and the Mediterranean region to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; cultivated throughout the Arabian Peninsula.

Distribution map & Illustration: 543.

Notes: Leaves have been used in traditional medicine as treatment of bronchitis and coughs. The latex is toxic; the leaves are unpalatable to goats and camels.

4. **Carissa** L.

A genus of about 37 species distributed in Africa, Asia, Australia, Madagascar, the Comoros, Seychelles and Mascarenes.

Carissa spinarum L., Mant. 1: 52 (1767) & Syst. Ed. 12, 2: 189 (1770).
Synonyms: *Antura* Forssk. (1775) without epithet. Type: Yemen, Mt Hadie, *Forsskål* 234 (holotype C; isotypes BM, S); *Carissa edulis* Vahl. (1790).
Vernacular name: folk (Jibbālī).

Description: Spiny shrub, up to 3 m, branching profusely, occasionally scrambling with a scaly greyish bark. Spines simple and forked, straight, rigid, 0.8–3 cm. Leaves opposite, 1–3(–5) × 0.5–1.5(–3) cm, ovate to ovate-elliptic, base cuneate to rounded, apex acute to sometimes mucronulate, margins entire, shortly tomentose; stipules absent. Flowers fragrant, white, tinged pink, in terminal corymbs; pedicels 0–2 mm. Calyx 2 mm, 5-lobed above to half its length, tomentose. Corolla tubular, widest at throat, 5-lobed above, the lobes spreading; tube cylindrical, 7–8 mm, lobes 6 × 2 mm, oblong-ovate, acute, ciliate, overlapping to the right in bud. Stamens 5; filaments short, inserted towards the top of corolla tube, included. Fruit a globose berry, 8–10 mm in diameter, fleshy, dark brownish-red when mature.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, in the escarpment mountains and the summit plateau, with *Anogeissus* and *Acacia*. *Altitude*: 300–900 m. Widespread in tropical Africa (from Senegal to Somalia, Sudan to South Africa and Namibia), Madagascar, tropical Asia and Australia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 544.

Notes: The berries have been used in tradition medicinal for abdominal pain, constipation, gastro-enteritis and menstrual pain, and the leaves made into a poultice for toothache.

Cultivated species

Catharanthus roseus (L.) G.Don
Low shrub with white latex. Leaves opposite and decussate, 4–9 × 1.5–3.5 cm obovate, apex emarginate to obtuse. Flowers white, pink or purple with a dark centre. Corolla tubular, lobes spreading. Follicles green.
Cultivated widely in private gardens and public parks throughout Oman.

Plumeria rubra L.
Small tree with ± repeated divaricate branching, latex white; branchlets succulent. Leaves alternate, 12–40 × 3–12 cm, elliptic, acuminate, glaucous. Flowers white or pink or reddish-pink, usually with a yellow throat, infundibuliform, fragrant. Follicles divergent. Seeds winged.
Cultivated in private gardens and public parks throughout Oman.

Thevetia peruviana K.Schum.
Small tree, or often shrubby, with white latex. Leaves alternate, 6–10 × 0.5–5 cm, narrowly elliptic, apex acute. Flowers axillary, yellow; corolla infundibuliform. Fruit drupaceous, obtriangular, apiculate, mesocarp fleshy.
Cultivated in private gardens and sometimes seen in public parks. Its cultivation in public parks is discouraged due to the poisonous nature of the seed kernel.

Subfamily **Periplocoideae**

5. **Periploca** L.

Fourteen species distributed from Macaronesia through to the Mediterranean east to Himalaya, China and Indo-China and tropical Africa.

Corolla purple with green margins and a pale yellow median stripe fringed with long white hairs; glands absent at base of corolla lobes ..... 1. **P. aphylla**

Corolla reddish-purple with yellow margins (Dhofar) or entirely yellow (N Oman), glabrous; glands present at base of corolla lobes ..... 2. **P. visciformis**

1. ***Periploca aphylla*** Decne., in Jacquem., Voy. Bot. 109: t. 116 (1844).

Vernacular names: handabub; kilkil (Eastern Hajar).

Description: Shrub, up to 2 m; stems branched, thick and rigid, leafless, yellow-green. Latex white. Leaves falling soon, opposite, 3–12 × 1–5 mm, ovate-oblong, apex obtuse, thick and leathery. Flowers about 10 mm across, in axillary or terminal clusters; pedicel 2–3 mm. Calyx 5-lobed to half its length; lobes 2–3 mm, ovate, obtuse, ciliate. Corolla 5-lobed almost to base; lobes spreading or reflexed, oblong, 5–7 × 2–4 mm, purple with a green margin and elliptic white or pale yellow median stripe, fringed with long white hairs; corona 3-segmented, central purple, filiform, 6–7 mm long, lateral fleshy, ovoid, reddish, fused to the inner base of corolla lobe. Stamens 5 with short filaments; anthers bearded; pollen in tetrads; pollen translators spatulate. Fruit of single or paired follicles, 6–12 cm, cylindrical, tip tapering, acute, widely divergent becoming hard when mature. Seeds flattened with a tuft of hairs at the tip.

Flowering & fruiting: February to March.

Distribution and habitat: Throughout Oman, including Musandam, at low and high altitudes of the northern and southern mountains, and in the foothills and the drier regions of the Dhofar mountains. *Altitude*: 500–2000 m. Distributed from N Africa to W Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 545.

Notes: The extract of plant or crushed plant has been used in traditional medicine to treat skin tumours and swellings to reduce pain.

2. ***Periploca visciformis*** (Vatke) K.Schum., Nat. Pflanzenfam. 4, 2: 216 (1895).

Basionym: *Leptadenia visciformis* Vatke (1876). *Synonyms*: *Socotora visciformis* (Vatke) Bullock (1955). —Type: Somalia, *Hildebrandt* 1432 (holotype BM). *Socotora aphylla* Balf.f. (1883). Type: Socotra, *Balfour* 327 (holotype E).

Vernacular names: handabub, kilkil (Eastern Hajar).

Description: Erect or ± straggling or trailing shrub, up to 2 m; stems branched, leafless, greenish to brownish. Latex white. Leaves falling soon, opposite, 10–15 × 1 mm, linear-lan-

ceolate, base cuneate, apex acute, leathery, glabrous; bracteate leaves ± 1 mm, naviculate, persistent. Flowers in axillary or terminal clusters, 2–3(–5)-flowered or flowers solitary; pedicel 2–3 mm. Calyx 5-lobed to half its length; lobes 0.5–1 mm, ovate, obtuse, glabrous. Corolla 5-lobed almost to base; lobes reflexed, oblong, 5–7 × 2–4 mm, purplish-red with a yellow margin (Dhofar) or entirely yellow (N Oman), and an elliptical whitish glandular spot present at the base of lobe; corona 3-segmented, central green, filiform, 3–4 mm long, lateral fleshy, ovoid, reddish, fused to the inner base of corolla lobe. Stamens 5 with short filaments; anthers bearded; pollen in tetrads. Follicles 4–6 cm, linear, tip tapering, acute, divergent, becoming hard when mature. Seeds flattened with a tuft of hairs at the tip.

Flowering & fruiting: September to March.

Distribution and habitat: Throughout Oman, in the northern and southern mountains and foothills with *Dodonaea*, *Sideroxylon* and *Grewia*, and in the drier regions of the Dhofar mountains, on rocky banks and slopes of dry wadis, and the plateau of Jebel Semhan. *Altitude*: 500–2000 m. Distributed in Somalia and Ethiopia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 546.

6. **Raphionacme** Harv.

Thirty species distributed in tropical Africa south to South Africa.

Raphionacme arabica A.G.Miller & Biagi, Notes R.B.G. Edinb. 45(1): 61 (1988).
Type: Oman: Dhofar, 10 km E of Taqah, 11 Jan. 1985, *I.M. McLeish* 480 (holotype E).
Vernacular names: estah, sutah, sedah istah (Jibbali).

Description: Erect perennial herb, arising from a swollen brownish-white rootstock. Latex white. Stems annual, up to 20 cm, pubescent, reddish-brown. Leaves typically 4, at first appearing together opposite each other, later opposite as the stem elongates, 2.6–4 × 1.3–2 cm, elliptic to obovate to oblong-ovate, base cuneate, apex acute to obtuse, margins entire, ciliate, pubescent, veins reddish-brown, green above, pale green to reddish tinged beneath; petiole 4–10 mm. Inflorescence terminal, above the leaves, dichotomously branched below, corymbose above; pedicels 1–2 mm; bracts oblong. Flowers 1cm across; corolla tube 1 mm, lobes erect, 5–8 mm, oblong-obovate, spreading, white with purple central stripe, greenish at the base, pubescent outside, glabrous inside; corona lobes brownish-purple with green tips, 4–6 mm, linear-oblong, fused to the base of corolla lobes, cohering at the top. Stamens glabrous, attached to the inner base of the corona. Fruits paired, erect.

Flowering and fruiting: June (before the monsoon).

Distribution and habitat: Southern Oman, Dhofar and SE Yemen. In Dhofar found in the rocky and stony locations in the mist affected escarpment mountains. *Altitude*: 300–700 m.

Distribution map & Illustration: 547.

Notes: A regional endemic; the species is rare in Oman and extremely localised in its dis-

tribution. Its "out of season" flowering time protects it from collectors. Its conservation status at a regional level is assessed as Endangered [En B1 a & b], based on its small area of occupancy and a continuing decline in the quality of its habitat. The rootstock is highly prized by the local inhabitants for its sweet taste.

Subfamily **Asclepiadoideae**

7. **Cibirhiza** Bruyns

Two species distributed in Tanzania, Zambia, Zimbabwe and S Arabia.

Cibirhiza dhofarensis Bruyns, Notes R.B.G. Edinb. 45(1): 51 (1988).
Type: Oman, Dhofar, cliff tops of Ras Hamar, 15 km W of Salalah, 18 Sept. 1985, *A.G. Miller* 7525 (holotype E; isotypes K, ON, OXF, UPS).
Vernacular names: sefot, sifod (Jibbali); seyfod (Dhofari Arabic).

Description: Prostrate or scrambling shrub with a large swollen underground tuber; stems trailing or sometimes twining, up to 150 cm; latex milky. Leaves opposite, petiolate, 4–15 × 2–10 cm, ovate to ovate-oblong, base cordate to truncate, apex acute, margins entire, somewhat undulate, densely pubescent below, thinly pubescent above; petiole 1–6 cm, long pubescent. Flowers fleshy, in axillary clusters. Calyx 5-lobed to the base; lobes 2.5–3 mm, linear-ovate, crisp pubescent. Corolla rotate, 5-lobed, 12–14 mm across; lobes fleshy, spreading, 4–5 mm, triangular-ovate, greenish to brownish or purplish with dark purple spots, puberulous above, short tomentose below; corona white, 3 mm across, in two series: outer lobes united into a 5-sided disc appressed to the surface of the corolla, an upward and inwardly pointing tooth arising from each lobe, lobes marked by a groove running from the margin to centre of flower; inner lobes at first erect with dorsal thickening and appressed to backs of anthers, then cylindrical and recurved away from centre of column, 1–2 mm long. Stigmatic surface covered with a thin membrane covering the short, grooved, rectangular anthers. Pollinia solitary in each anther cell. Fruit (follicle) ± 6 cm, ovoid, only one developing.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar and SE Yemen, in the foothills and upper altitudes of the escarpment mountains, amongst rocks, rooting in rock crevices with *Adenium obesum*, *Anogeissus* and *Commiphora-Acacia* scrub. *Altitude*: 30–750 m. Endemic, not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 548.

Notes: The distribution of the species is localised and it is at risk from collectors. Its conservation status at a regional level is assessed as Endangered [En B1 a & b], based on its small area of occupancy and a continuing decline in the quality of its habitat. The tubers are edible. The above description is taken largely from Miller & Morris, Plants of Dhofar, 1988: 60).

8. **Glossonema** Decne.

Five species distributed from Mali east to Somalia, and south to Tanzania; Arabian Peninsula, eastern Pakistan and western India.

Glossonema varians (Stocks) Benth. ex Hook.f., Fl. Brit. Ind. 4: 16 (1883).

Basionym: *Mastostigma varians* Stocks (1851). Type from Persia and Baluchistan. *Synonyms*: *Glossonema edule* N.E.Br. (1895). Type: Oman: Dhofar, at foot of the mountains, *J.T. Bent* 175 (holotype K); *G. arabicum* Deflers (1896).

Vernacular names: ghemrez, ghamradeh, teqelum (Jibbali).

Description: Perennial herb; stems ascending to prostrate, up to 20 cm, thinly to densely pubescent with white patent hairs. Leaves grey-green, opposite, petiolate, 1–3(–5) × 1–3(–4) cm, ovate to circular, cuneate, apex acute to sometimes mucronulate, margins entire, undulate, pubescent; petiole 5–20 mm, long, pubescent. Flowers in few-flowered axillary clusters, more or less throughout the length of stems; pedicels ± 1 mm. Calyx 5-lobed to base; lobes 3–4 mm, subulate, pubescent. Corolla white to pink, or medially greenish, pink on margins, campanulate, 5-lobed; lobes 3–5 mm, oblong-ovate, obtuse; corona white to cream, with 5 segments, basally attached to the corolla and alternating with the corolla lobes; segments 1.5–2.4 mm, ovate, tip entire or bifid. Staminal column short; pollinia solitary in each anther loculus, pendulous. Follicle 3–6 cm, ellipsoid, covered with spines soft at first later hardening, 5–8 mm long. Seeds with a tuft of white hairs at the tip.

Flowering and fruiting: September to October.

Distribution and habitat: Central and Southern Oman, on the central gravel plains, and on the foothills and coastal hills of the escarpment mountains, in sand, cracks of rocks and amongst rocks. *Altitude*: 100–1000 m. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 549.

9. **Calotropis** R.Br.

Four species distributed from Macaronesia, N and tropical Africa and Arabia to India eastwards to Australia; introduced in central and southern America.

Calotropis procera (Ait.) W.T.Ait., Hort. Kew. ed., 2, 2: 78 (1811).

Basionym: *Asclepias procera* Ait. (1789). *Synonym*: *Madorius procerus* (Ait.) Kuntze (1891).

Vernacular names: ashkar, oshar, oshur, ushar.

Description: Shrub or small tree, up to 3 m, branching from the base, grey-green; bark grey, deeply fissured; upper branches usually with scars of leaf bases. Latex milky. Leaves opposite, somewhat fleshy, 8–15 × 4–10 cm, broadly ovate to obovate, apex acute, base cordate, margins entire, upper surfaces thinly lanate becoming glabrous, lower white mealy, lanate; petiole very short or absent. Flowers in terminal and axillary, umbellate cymes; peduncle

up to 10 cm; pedicels 2–4 cm. Calyx somewhat fleshy, 5-lobed almost to base; lobes 5–6 mm, triangular, greenish white, tinged purple at the tips. Corolla campanulate, 5-lobed; lobes broadly ovate, 10 × 8 mm, greenish-white outside, purple inside. Corona purple, of 5 laterally compressed fleshy lobes, each radially cleft at the top and with a basal upcurving spur. Pollinaria of a pair of pendent flattened pollinia. Fruit of paired follicles, 5–10 cm, ovoid, inflated. Seeds with a tuft of hairs at one end.

Distribution and habitat: Throughout Oman in the foothills of the mountains, wadis banks and bottom, and gravel and sandy plains, often in cultivated and waste places, along roadsides and around towns and villages. *Altitude*: 0–800 m. Distributed in subtropical Africa and SW Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Flowering & fruiting: January to April; but also at other times of the year.

Distribution map & Illustration: 550.

Notes: The leaves and the latex have been used in traditional medicine for treating wounds, pain, scorpion stings and for strengthening muscles affected by paralysis. Bark of the root is also used medicinally as a diaphoretic and as an emetic. Also used to treat hard lumps on camel limbs, where these are cut and sap dropped into the wound.

There is also some black magic attached to this plant where evil doers will pray to this plant for forty days at the end of which it is believed a root will arise from the earth and dance; this is cut off and used in black magic, for warding off evil eye etc. (recorded on a sheet from Madinat Qaboos by R.E. Ash 64 in 1984).

The fresh leaves are unpalatable to livestock; fruit and flowers are eaten by goats and camels; in Oman the dominance of this species at many locations, together with *Solanum incanum* is an indicator of overgrazing.

10. **Gomphocarpus** R.Br.

Twenty-five taxa in 20 species distributed in the drier parts of Africa, Arabia, Sinai, Israel and Jordan.

Gomphocarpus fruticosus (L.) W.T.Ait., Hort. Kew ed. 2, 2: 80 (1811).
Basionym: *Asclepias fruticosa* L. (1753).

subsp. ***setosus*** (Forssk.) Goyder & Nichols, Kew Bull. 56(4): 787 (2001).
Basionym: *Asclepias setosa* Forssk. (1775). Type: Yemen, Al Hayiyah, *Forsskal* 264 (holotype C). *Synonym*: *Gomphocarpus setosus* (Forssk.) R.Br. ex Schult. (1820).
Vernacular names: herum, isenu etirin (Jibbali).

Description: Erect shrub, 50–100 cm; latex white. Stems simple or branched, thinly tomentose. Leaves opposite, 6–12 × 0.5–1.5 cm, narrowly oblong to narrowly obovate, base obtuse, apex acute, margins entire, often inrolled, glossy green above, paler green below, veins whitish beneath; petiole 2–3 mm. Flowers in pendulous pedunculate umbellate cymes; pedicels 8–12 mm. Calyx 5-lobed; lobes 3–4 mm, linear. Corolla lobes 5, 7–8

mm, ovate, spreading, yellowish-green, glabrous, shortly ciliate on the margins; corona of 5 oblong segments, lobes as long as broad, dark green, attached to base of staminal column, compressed and infolded, each with a pair of short teeth on inner angles, producing nectar; pollen in pollinia, pendulous. Fruits of paired or solitary follicles, inflated, 6–7 cm, ovoid, covered with soft bristles, thinly pubescent. Seeds with a tuft of white hairs at one end.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar on the escarpment woodlands, exposed rocky ground, along roadsides and disturbed areas. *Altitude*: 350–850 m. Distributed in Somalia, Ethiopia and Eritrea. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 551.

Notes: Unpalatable to livestock; often one of the dominant species in overgrazed areas. Subsp. *fruticosus* is native to southern Africa and naturalised elsewhere.

Wild collected seed of this species is held at the Millennium Seed Bank at Wakehurst Place, Royal Botanic Gardens, Kew.

11. **Pergularia** L.

About five species distributed in Africa, Arabia, Middle East to India and Indo-China.

Fruit covered with soft spines and tubercles ..... 1. **P. tomentosa**
Fruit covered with reddish-brown soft bristles ..... 2. **P. daemia**

1. ***Pergularia tomentosa*** L., Mant. Pl. 53 (1771).

Type: Presumably grown at Uppsala from seed collected by Forsskål, no type in Herb. LINN.

Synonyms: *Asclepias cordata* Forssk. (1775); *Daemia cordata* (Forssk.) R.Br. (1809). Type: *Forsskal* 269 (C), 270 (C) & *Forsskal* s.n. (BM), labelled as type of *A. cordata*; *Daemia tomentosa* (L.) Pomel (1860). Type: Burman, Fl. Indica, p. 72, t. 27, f. 2 (as *Asclepias cordata*).

Vernacular names: geygeh, ghalaqah, shajarat al jalud.

Description: Perennial herb; stems twining, grey-green, tomentose. Latex milky. Leaves opposite, petiolate, 14–30 × 10–30 mm, broadly ovate to almost circular, base cordate, apex acute, margins entire, grey-green tomentose. Flowers in pedunculate, axillary umbellate cymes; pedicel 2–3 cm. Calyx 5-lobed almost to base, lobes 2–3.5 mm, elliptic, acute, tomentose. Corolla brownish-white, or sometimes yellow-white, 5-lobed to about half, lobes 6–8 mm, elliptic-lanceolate, ciliate, spreading. Corona white, in two series: the outer arising at the base of the staminal column, 5-lobed, membranous; the inner of 5 fleshy lobes, attached to base of staminal column, horn-like above, incurved, spurred below. Stamens united to form a column, white. Pollinia single in each anther loculus. Fruit of paired follicles, erect, 4–6(–7) cm, narrowly ovoid with an acute tip, grey-tomentose, with soft spines and tubercles. Seeds flattened with a white tuft of hairs at the tip.

Flowering & fruiting: October to April.

Distribution and habitat: Throughout Oman, including Masirah Island, in the foothills and coastal plains, dried wadi beds and banks, beside roads, and drier regions of the north facing slopes of the Dhofar mountains, climbing and scrambling over other shrubs; common. *Altitude*: 10–700 m. Distributed from northern Africa, through the Arabian Peninsula to SW Pakistan. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 552.

Notes: The latex of the plant has been used in traditional medicine on skin sores and other skin disorders, and the extract of the plant has been used as a purgative and expectorant.

2. ***Pergularia daemia*** (Forssk.) Chiov., Res. Sci. Mus. Stefan-Paoli Somal. Ital. 1: 115 (1916). *Basionym*: *Asclepias daemia* Forssk. (1775). Type: Yemen, *Forsskal* (not traced). *Synonym*: *Daemia forskalii* Schult. (1820).

Description: Perennial herb; stems twining, grey-green, pubescent-tomentose. Latex milky. Leaves opposite, grey-green, petiolate, 40–85 × 20–75 mm, broadly ovate, base cordate, apex acute, margins entire, pubescent to glabrous or ciliate; petiole 25–50 mm, tomentose. Flowers in pedunculate, axillary umbellate cymes; pedicel 2–2.5 cm. Calyx 5-lobed; lobes 2–3 mm, triangular, acute, tomentose. Corolla greenish-yellow, 5-lobed to about half, lobes 6–7 mm, elliptic-lanceolate, ciliate, spreading. Corona white, in two series; the outer arising at the base of the staminal column, 5-lobed, membranous; the inner of 5 fleshy lobes, attached to base of staminal column, horn-like above, incurved, spurred below. Stamens united to form a column, white. Pollinia single in each anther loculus. Fruit of paired follicles, erect, 35–50 mm, narrow ovoid with an acute tip, grey-tomentose, softly spiny with long brownish soft spines and lanate. Seeds flattened with a white tuft of hairs at the tip.

Flowering & fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, in foothills and lower slopes of the escarpment mountains, in shaded locations. *Altitude*: 10–500 m. Distributed in Egypt. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 553.

Notes: The species has been used traditionally to loosen hair on hides for tanning. The latex, if rubbed over skin or eyes can cause inflammation and pain, and if ingested can cause stomach cramps and diarrhoea.

12. **Pentatropis** R.Br. ex Wight & Arn.

Six species distributed from Senegal east to Somalia and south to Tanzania; Arabia through to India; New Guinea and Australia.

Pedicels slender, 5–10 mm; corolla divided ± to base, lobes triangular ..... 1. **P. nivalis**
Pedicels stout, 2–3 mm; corolla not divided to base, lobes narrowly oblong ..... 2. **P. bentii**

1. ***Pentatropis nivalis*** (G.F.Gmel.) D.V.Field & J.R.I.Wood, Kew Bull. 38: 215 (1983).
Synonyms: *Asclepias nivea* Forssk. (1775). Type: Yemen, *Forsskål* 272 (holotype C); *Asclepias forskaolii* Schult. (1820).
Vernacular name: skelwan.

Description: Perennial herb; stems twining, up to 4 m, yellowish-green, glabrous or glabrescent; latex clear. Leaves opposite, petiolate, fleshy especially when growing in dry saline habitats, 1–5 × 0.4–3 cm, narrow oblong to oblong to oblong-ovate, base rounded to somewhat cordate, apex obtuse with a mucro, margins entire, grey-green, glabrous. Flowers in axillary clusters; pedicel 1–1.5 cm. Calyx 5-lobed, lobes 2–3 mm, triangular, acute. Corolla pale yellow to greenish-yellow, 5-lobed; lobes 6–10 mm, linear-oblong, spreading, the ends spiralling, glabrous outside, minutely pubescent inside. Corona greenish, in one series, of 5 laterally compressed segments alternating with the corolla lobes, attached towards the top of the staminal column; segments with an acute incurved tip. Stamens united to form a column; pollinia single in each anther locule, pendulous. Fruit of solitary or (rarely) paired follicles, ± erect, 5–7 cm, ovoid narrowing into an acute tip, glabrous. Seeds flattened with a white tuft of hairs at the tip.

Flowering and fruiting: September to October.

Distribution and habitat: Throughout Oman, on the lower foothills of the northern and southern mountains, sandy and gravel plains, coastal plains, wadi sides and bottom, along roadsides; climbing and trailing over *Acacia* trees and other shrubs; common. *Altitude*: 0–600 m. Found throughout Africa, Mediterranean east from Arabia through Iran, Afghanistan to Baluchistan and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 554.

Notes: Plants growing near coasts tend to have succulent leaves, and can be confused with the *P. bentii*.

2. ***Pentatropis bentii*** (N.E.Br.) Liede, Bot. J. Linn. Soc. 114(1): 91 (1994).
Basionym: *Strobopetalum bentii* N.E.Br. (1894). Type: Yemen, T.J. Bents's Hadramaut Expedition 1893–94, Chail-bawazis, 1.2. 1894, No. 229 (holotype K).

Description: Perennial herb; stems creeping, yellowish-green, glabrous or glabrescent; latex clear. Leaves opposite, petiolate, fleshy, 10–30 × 10–25 mm, broadly oblong to orbicular, base rounded to somewhat cordate, apex obtuse with a mucro, margins entire, grey-green, glabrous. Flowers 2–4, in axillary clusters; pedicel 2–3 mm. Calyx 5-lobed, lobes 2–3 mm, triangular, acute. Corolla pale yellow to greenish-yellow, with a narrow tube, obscuring the gynostegium, 5-lobed; lobes 4–8 mm, linear-oblong, spreading, the ends spiralling, glabrous outside, densely minutely pubescent inside. Corona greenish, in one series, of 5 laterally compressed segments ± as long as the gynostegium, fleshy. Stamens united to form a column; pollinia single in each anther locule, pendulous. Fruit of solitary

or (rarely) paired follicles, ± erect, ± 5 cm, ovoid narrowing into an acute tip, glabrous. Seeds flattened with a white tuft of hairs at the tip.

Flowering and fruiting: February/March.

Distribution and habitat: Southern Oman, Dhofar, along coastal foot hills at base of Jebel Semhan near Hasik. *Altitude*: 10–60 m. Distributed in Somalia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 555.

Notes: *P. bentii* (N.E.Br.) Liede, was recently reported from Oman (Raffaelli et al. in Webbia (2008), 63(2): 161–167). This is a rare species so far known only from Yemen and Somalia. Its conservation status at a regional level is assessed here as Endangered [EN D 2] due to its very small population known from less than five locations. A new road has recently been built to Hasik making this area easily accessible and highly prone to development and disturbance.

13. **Cynanchum** L.

About 300 species found throughout the tropics and subtropics, Madagascar, and southern China.

Cynanchum gerrardii (Harv.) Liede, Taxon 40(1): 117 (1991).

Basionym: *Sarcocyphula gerrardii* Harv. (1863). *Synonyms*: *Cynanchum sarcostemmatoides* K.Schum. (1895); *C. tetrapterum* sensu auctt. non (Turcz.) R.A.Dyer ex Bullock.
Vernacular names: halbelib, halbelob (Jibbali).

Description: Perennial climber, up to 1 m or more; stems leafless, branched, striate, somewhat succulent, thick, glabrescent, glabrous; latex white to yellowish. Leaf scales triangular, acute. Flowers in extra-axillary inflorescences, fragrant; pedicel 2–4 mm, glabrous. Corolla greenish-white, 5-lobed, fused basally; lobes ± 3 mm, ovate; coralline corona absent; gynostegial corona white, lobes fused to about ¾ of length, erect or inflexed at the apex, connate to the filament. Follicles single or paired, ± 8 cm, with a short beak at the apex.

Flowering & fruiting: September.

Distribution and habitat: Southern Oman, on Dhofar mountains in *Euphorbia balsamifera* shrub zone. *Altitude*: ± 900 m. Distributed from Somalia to South Africa, Madagascar, Comores. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 556.

14. **Sarcostemma** R.Br.

Fifteen species distributed from tropical Africa to South Africa, S Arabia eastwards to India through to Australia and New Caledonia.

Sarcostemma viminale (L.) R.Br., Prodr. Fl. Nov. Holland.: 464 (1810).
Basionym: Euphorbia viminale L. (1753).

subsp. ***stipitaceum*** (Forssk.) Meve & Liede, Bot. J. Linn. Soc. 120: 32–35 (1996).
Synonyms: *Asclepias stipitacea* Forssk. (1775). Type: Yemen, *Forsskål* 277 (holotype C); *Sarcostemma stipitaceum* (Forssk.) Schult. (1820).
Vernacular name: bidol (Dhofari Arabic).

Description: Perennial shrub, up to 1 m forming tangled clumps; stems scrambling, dichotomously branched, articulated at the nodes, fleshy, 3–7 mm in diameter, blue-green, glabrous (see note below); latex white. Leaves absent or reduced to small triangular scales. Flowers in extra-axillary inflorescences, faintly fragrant, in umbellate clusters present at nodes; pedicel 6–12 mm. Corolla pale yellow, rotate, 5-lobed almost to base; lobes 5–6.5 × 2 mm, ovate-oblong, margins reflexed, glabrous (lobes reflexed when the flower is in full bloom); corona double; outer corona white, cup-like, 5-lobed, inner thick, fleshy, lobes attached to the central column 2–3 mm long. Fruit of paired follicles, 10–13 cm, linear-ellipsoid, divergent. Seeds with a tuft of hairs at the tip.

Flowering & fruiting: May to July, but also sporadically at other times of year. The aerial parts die back after the monsoons.

Distribution and habitat: Northern and southern Oman, in the eastern Hajar mountains, and in the drier parts of the Dhofar mountains and the north facing wadis, with *Euphorbia balsamifera*, *Commiphora*, *Adenium*. *Altitude*: 400 -1200 m. Distributed in Sudan, Somalia, Ethiopia, Kenya, Tanzania and South Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 557.

Notes: According to Meve & Liede subsp. *stipitaceum* forms erect shrubs with non-twining, rarely scrambling stems, which are densely pubescent when young, and with flowers on short lateral shoots. H.A. Jonkers (pers. comm., 2009) notes that Miller's description in *Plants of Dhofar* could well be based on plants from elsewhere in Arabia. Susannah Stuart-Smith's illustration (p. 51) shows the infloresecence positioned at the end of the main stem and on long laterals. According to her, her original *Sarcostemma* sheet contains references to Kew glasshouse 34 (*Field* 200 and *Bally* 11739), and to an unnamed collection at Edinburgh (fruit and seeds), (pers. com. to Jonkers 2002). However, it remains unclear on which material the habit drawing was actually based. In spite of the different position of the inflorescence, the illustration was nonetheless cited by Meve & Liede under subsp. *stipitaceum*. In Dhofar, Jonkers saw only erect plants, never scrambling or twining.

The whole plant is used as a general tonic and as a cleanser of the digestive system.

15. **Leptadenia** R.Br.
About four species distributed from N Africa south to Cameroon, eastwards to Uganda and Kenya, through Arabia to India.

Leptadenia pyrotechnica (Forssk.) Decne., Ann. Sc. Nat., Bot. sér. 2, 9: 269 (1838).
Synonym: *Cynanchum pyrotechnicum* Forssk. (1775). Type: Yemen, Wadi Mawr ("Mor"), *Forsskål*, type not traced.
Vernacular name: markh.

Description: Perennial shrub, 1–3 m, rarely taller, with many leafless stems. Stems green, branching, terete, up to 1 cm in diameter, ending in points. Latex clear, yellowish-green. Leaves falling soon, linear- lanceolate. Flowers ± 6 mm across, yellow-green, in axillary clusters; pedicels 2–2.5 mm, tomentose. Calyx 5-lobed almost to base; lobes 2–2.5 mm, oblong, yellow-green with pale yellow margins, sometimes revolute, pubescent inside and outside. Corona white; lobes strap-shaped, alternating with the corolla lobes, incumbent over the staminal column. Follicles 9–13 cm, narrowly cylindrical, tapering towards the apex. Seeds plumose at the apex.

Flowering & fruiting: October to November.

Distribution and habitat: Throughout Oman, in open woodland on hillsides, sandy and gravel plains and sandy wadis, and edges of sand deserts, with *Acacia*, *Commiphora*. *Altitude*: 20–400 m. Distributed in tropical Africa, eastwards through Arabia, Iraq, Iran, Afghanistan to Pakistan and Sind. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 558.

Notes: An infusion made from branches and stems has been used as a diuretic in traditional medicine.

Dried hair tufts of seeds were used by Bedouins for tinder and may be the reason for its specific epithet "pyrotechnica". Browsed by goats and camels.

16. **Ceropegia** L.
Some 160 species distributed throughout Africa.

Leaves 3–12 × 0.5 cm, narrow ovate to ovate-oblong ..... 1. **C. bulbosa**
Leaves 5–10 × 2–3 mm, linear, falling soon ..... 2. **C. botrys**

1. ***Ceropegia bulbosa*** Roxb., Pl. Corom. 1: 11 (1795).
Synonym: *C. vignaldiana* A.Richard (1851).

Description: Perennial herb; stems annual arising from a depressed globose tuber 3–4 cm across; stems slender, up to 1 m, sparsely hairy to glabrous. Leaves opposite, 3–12 × 0.5–4 cm, narrow-ovate to ovate-oblong, base obtuse to subcordate, apex acute, margins entire, glabrous; petiole 1–2 cm. Flowers in 2–5-flowered axillary pedunculate cymes, peduncle 1–3 cm; pedicels 5–8 mm. Calyx 5-lobed, lobes 2 mm, linear, acute. Corolla tubular, 5-lobed above, 20–28 mm; tube ± 14 mm, with a basal globose base and a cylindrical tubular portion expanding into funnel-shape above, greenish below, purplish-green above; lobes ± 8 mm, linear, fused at the top, margins reflexed, greenish-purple, with long purple

hairs; corona in 2 series: outer corona of 5 segments, horseshoe-shaped, white; inner corona of 5 erect segments. Staminal column short, included in the basal portion of the corolla. Pollinia erect, solitary in each anther loculus. Follicles paired, 6–12 cm, narrow cylindrical, acute, smooth, grey-green, glabrous. Seeds with an apical tuft of hairs.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in shade and humid places, in the *Anogeissus* woodland, and in the *Euphorbia balsamifera* zone, often trailing and climbing over shrubs. *Altitude*: 500–850 m. Distributed in NE Africa (type from NE Africa), Arabia, India and Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia and Yemen.

Distribution map & Illustration: 559.

2. ***Ceropegia botrys*** K.Schum., Bot. Jahrb. 33: 328 (1903).
Synonym: *Ceropegia mansuriana* Chaudhary & Lavranos (1985). Type: Saudi Arabia, Abu Arish, *Chaudhary* 900A (E; RIY).

Description: Perennial herb; stems arising from a top-shaped to irregularly rounded tuber; stems climbing, up to 2 m, glaucous, glabrous. Leaves opposite, 5–10 × 2–3 mm, linear, base narrowing, apex acute, margins entire, ciliate, glabrous, falling soon. Flowers in 2–5-flowered axillary pedunculate cymes, peduncle up to 4 mm; pedicels 8–12 mm. Calyx 5-lobed, lobes ± 5 mm, subulate. Corolla tubular, 5-lobed above, 20–28 mm, with a basal globose base and a cylindrical tubular portion expanding into funnel-shaped above, greenish below, purplish grey blotched on white and then greyish white with darker veins above; basal inflated part of tube 6–8 mm, with purple papillae; lobes 26–30 mm, linear, margins reflexed, whitish with purple-grey veins and hairs, connivent and then diverging and converging again and fusing to form a second cage 8–11 mm long; corona in 2 series: outer corona of 5 segments, greenish white; inner corona of 5 segments, incumbent on anthers. Staminal column short, included in the basal portion of the corolla. ?Follicles paired.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in the *Anogeissus* woodland, trailing and climbing over shrubs. *Altitude*: 300–750 m. Distributed in Somalia (from where the type originates). Elsewhere in the Arabian Peninsula found in Saudi Arabia and Yemen.

Distribution map & Illustration: 560.

Notes: Not common, but perhaps over-looked due to its overall similarity to *C. bulbosa* and not collected; known from at least 4 localities in Dhofar (see Collenette in Asklepios 83: 20, 2001). On the National Red List this species is assessed as Endangered [EN B1 a & b], based on its small area of occupancy and a continuing decline in the quality of its habitat.

17. **Caudanthera** Plowes

Three species distributed in Africa, Arabia, and from Iran to India.

Caudanthera edulis (Edgew.) Meve & Liede, Plant Syst. Evol. 234: 201 (2002).

Basionym: *Boucerosia edulis* Edgew. (1862). *Synonyms*: *Caralluma edulis* (Edgew.) Benth. & Hook.f. (1876); *Boucerosia stocksiana* Boiss. (1879); *Cryptolluma edulis* (Edgew.) Plowes (1995).

Description: Erect to ascending, succulent-stemmed perennial herb; stems up to 40 cm, grey-green, leafless for most of the year; leaves 6–13 mm, linear, soon falling. Flowers greenish-brown to purplish-brown, solitary or 2 together, axillary on the flowering stalk 6–8 cm long, deciduous; pedicels ± 13 mm. Corolla campanulate, lobes, linear-lanceolate, 6–7 mm long; outer corona lobes bifid; inner corona-lobes incumbent over the anthers. Follicles erect, ± 10 cm.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, on coastal cliffs, amongst stones and rocks; a single locality from northern Oman in the coastal foothills of the eastern Hajar mountains. *Altitude*: 20–80 m. Distributed in N Africa, through Arabia to SW Pakistan (Baluchistan). Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 561.

Notes: The species has been recorded from only a few localities in Oman. At one of the localities which is in a large open sink hole in the coastal foothills of Eastern Hajar, a single small population was recorded growing on the wall. In late 1995 concrete stairs were built leading down to the water. In my last trip to the sinkhole (1999), I was not able to locate this population and I suspect that during the construction of the stairs this population was destroyed. Other localities for this species in Oman are in southern Oman in Dhofar. These are overgrazed, frequently visited by tourists and there are plans for development in the future. At one location, at Mughsayl, on a visit in 2006, I was not able to find the plants that I had recorded earlier in 1996. On the National Red List this species is assessed as Critically Endangered [CR A2 (a, c, d)], due to its narrow distribution range, a sharp decline in the population and decline of habitat. A small population has recently been recorded in Ibra, in Northern Oman (Patzelt et al., Edinb. J. Bot. 71: 172, 2014).

18. **Desmidorchis** Ehrenb.

Twelve species distributed in northern Africa and Arabia.

1. Flowers dark red to purplish-red 2
   Flowers white, pale to dark yellow or greenish-yellow 5
2. Corolla campanulate, ± 40 mm across ..... 1. **D. adenensis**
   Corolla ± 10 mm across 3

3. Stems up to 50 cm, short, not woody at base, not conspicuously 4-angled in cross-section, rib margins crenate to irregularly triangular 4
   Stems tall, up to 1.5 m, becoming woody at base, conspicuously 4-angled, rib margins dentate, the angles thin and flattened, appearing H-shaped in cross-section ..... 7. **D. acutangula**
4. Corolla rotate with a shallow tube; lobes with clavate hairs at the tips; gynostegium sessile ..... 2. **D. arabica**
   Corolla campanulate with a deeper tube; lobes without clavate hairs; gynostegium shortly stipitate ..... 3. **D. impostor**
5. Pedicels 25–35 mm; corolla creamy-white ..... 5. **D. tardellii**
   Pedicels 10–20 mm; corolla yellow or greenish-yellow with or without purple spots .. 6
6. Flowers 15–30 in apical umbels with a sweet unpleasant smell; corolla yellow ..... 4. **D. flava**
   Flowers up to 15 in apical or subapical umbels, not strong smelling 7
7. Plant up to 1 m, erect; old stems recurved; inflorescence subapical with up to 15 flowers; corolla lobes straight; pedicels up to 10 mm ..... 6. **D. penicillata**
   Plant up to 30 cm, erect to ascending; inflorescence apical; corolla lobes recurved ..... 8. **D. awdeliana**

1. ***Desmidorchis adenensis*** (Deflers) Meve & Liede, Plant Syst. Evol. 234: 202 (2002).
Basionym: *Boucerosia adenensis* Deflers (1896). Type: Yemen, Aden peninsula, Scham-Scham Mt., *Deflers* 65 & 518; Wadi Abyad, near Schoukra, *Deflers* 506, 863, 917, 1019; Mt Heys, *Deflers* 1163 (syntypes P).
Synonyms: *Caralluma adenensis* (Deflers) Berger (1910); *Caralluma kalmbacheriana* Lavranos (1965); *Caralluma rauhii* Lavranos (1965); *Crenulluma adenensis* (Deflers) Plowes (1995); *Crenulluma kalmbacheriana* (Lavranos) Plowes (1995); *Crenulluma rauhii* (Lavranos) Plowes (1995).

Description: Robust clump-forming succulent perennial herb; stems up to 4 cm and ± 25 mm across, light grey-green. Flowers in apical clusters, with about 20 flowers (15–50 in Yemen material), with an unpleasant carrion-like smell; pedicel 10 mm. Corolla campanulate, ± 40 mm across, densely papillose with dark red papillae; lobes with clavate hairs at tips or hairs lacking. Corona dark red, outer lobes pubescent, the inner lobes incumbent on the staminal column. Fruit (follicle) ± 12 cm, ovoid, acute, glabrous. Seeds plumose at tips.

Flowering and fruiting: June to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment hills, on hill slopes, and on limestone cliffs, with *Adenium*, *Commiphora*. *Altitude*: 350–700 m. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 562.

Notes: In Oman the distribution of this species is extremely localised, occurring only at a few localities, where only a few clumps are recorded. On the National Red List this species

is assessed as Endangered [EN B2 (a)], due to its narrow distribution range, and a general decline of habitat.

2. ***Desmidorchis arabica*** (N.E.Br.) Meve & Liede, Pl. Syst. & Evol. 202 (2002) (as "arabicus").
Basionym: *Boucerosia arabica* N.E.Br. (1895). Type: Yemen (S), Wadi Raida, near Saihut, *Hirsch* 28 (holotype K). *Synonyms*: *Caralluma arabica* N.E.Br. (1895); *Cremulluma arabica* (N.E.Br.) Plowes (1995).
Vernacular name: dij.

Description: Clump-forming succulent perennial herb up to 30 cm across; stems up to 35 cm, branching from the base, 4-angled in cross-section, ± 2 cm across, angles irregularly crenate to triangular, sometimes with white scars on the tips; stems grey-green to purple-brown. Leaves absent. Flowers in apical umbels with a carrion-like smell; pedicels 2–3 mm. Calyx 5-lobed almost to base, lobes 2–3 mm, narrowly triangular. Corolla dark purple-red, rotate to shallowly campanulate, 8–15 mm across, 5-lobed; lobes ovate, with clavate hairs at the tips; gynostegium not stipitate; corona in 2 series, dark reddish-purple; outer corona lobes erect, somewhat horn-shaped; inner lobes incumbent on the anthers. Pollinia solitary in each anther locule, ascending. Follicles paired, erect, 4–5 cm, ovoid, acute, glabrous. Seeds with a tuft of white hairs at the tip.

Flowering and fruiting: October-November; April-May.

Distribution and habitat: Northern Oman and Musandam, in the foothills, wadis and higher altitudes of western and eastern Hajar mountains, in rocky and hilly areas, amongst stones and small rocks, with *Euphorbia larica*, *Commiphora*, *Capparis*, *Ochradenus*. The species is also reported from Dhofar, but I have not seen any material from there. *Altitude*: 20–2300 m. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 563.

Notes: The epithet "aucheriana" for *Caralluma aucheriana* (Decne.) N.E.Br. which has been used for the purple-flowered stapeliad from Oman is not tenable, since the type of *Boucerosia aucheriana* Decne. (1844), Oman, Mascate, *Aucher-Eloy* 1128 (holotype P) lacks flowers, and it is not possible to distinguish the species on stem characters alone. The sympatric species, which looks very similar to *D. arabica* but without the clavate hairs at the tips of the corolla lobes is now described as a new species *D. impostor* Jonkers.

The plants are slow to grow and are easily uprooted by disturbance, such as making track roads on the hills or flash-floods following heavy rainfall. On the National Red List this species is assessed as Vulnerable [VU B1 (b iii)], due to its narrow geographic range of distribution and continuing decline in the quality of habitat.

The stems are used in traditional medicine as an emollient for sunburns and itchy skin, and tea prepared from the stems is taken for liver problems; juice of the stem is added to milk to curdle it and given to the sick for convalescence.

3. ***Desmidorchis impostor*** Jonkers, Bradleya 28: 76 (2010).
Type: Oman, Wadi Mistal, 400 m, 29 Sep. 1989, *Jonkers* 76 (holotype ON, in spirit).
Vernacular name: dij.

Description: Densely clump-forming succulent perennial herb up to 30 cm across; stems erect, up to 40 cm, branching from the base, 4-angled in cross-section, ± 2 cm across, angles irregularly triangular, sometimes with white scars on the tips; stems grey-green to purple-brown, with crenate margins. Leaves absent, rudiments ovate-deltoid. Flowers in apical umbels with a carrion-like smell, with 30–40 flowers; pedicels 1.5–3 mm. Calyx 5-lobed almost to base, lobes 2–3 mm, triangular. Corolla dark purple-red, campanulate, 7–10 mm across, 5-lobed; lobes ovate, without clavate hairs at the tips; gynostegium shortly stipitate, 1.5–2 mm long; corona in 2 series, dark reddish-purple; outer corona lobes erect, somewhat horn-shaped; inner lobes incumbent on the anthers. Pollinia solitary in each anther locule, ascending. Follicles paired, erect, 6–9 cm, ovoid, acute, glabrous. Seeds with a tuft of white hairs at the tip.

Flowering and fruiting: April to May; August to November.

Distribution and habitat: Northern Oman, at higher altitudes of western Hajar mountains, in rocky and hilly areas, amongst stones and small rocks. *Altitude*: 300–2300 m. Endemic to Jebel Akhdar, not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 564.

Notes: The conservation status of this species is assessed as Vulnerable [VU B1 (b iii)], due to its limited geographic range of distribution and continuing decline in the quality of habitat.

As for *D. arabica*, the stems are used in traditional medicine.

4. ***Desmidorchis flava*** (N.E.Br.) Meve & Liede, Plant Syst. Evol. 234: 203 (2002).
Basionym: *Caralluma flava* N.E.Br. (1894). Type: Yemen, Hadhramaut (Hadrhamaut), Wadi Hadiea, *Lunt* 184 (holotype K). *Synonym*: *Crenulluma flava* (N.E.Br.) Plowes (1995).
Vernacular names: zoja, izdot (Jibbali); duru el kebeh (Dhofar Arabic).

Description: Clump-forming succulent perennial herb up to 50 cm across; stems up to 30 cm, branching from the base, 4-angled in cross-section, 15–20 mm across, angles irregularly triangular with often prominent white scars on the tips; stems grey-green to purple-brown. Flowers in apical umbellate inflorescences of 15–30 flowers, unpleasantly and strong sweet smelling; pedicels 10–20 mm. Calyx 5-lobed almost to base, lobes 2–3 mm, narrowly triangular. Corolla bright to pale yellow, cup-shaped at base, 5-lobed; lobes spreading, 10–13 mm, narrowly triangular; corona in 2 series: outer corona lobes erect, bifid to the base with 2 narrow segments 3 mm long; inner lobes obtuse. Pollinia solitary in each anther locule, ascending. Follicles paired, erect, 9–10 cm, narrowly ovoid, acute, glabrous. Seeds with a tuft of white hairs at the tip.

Flowering and fruiting: January; September to October.

Distribution and habitat: Southern, Central and Northern Oman; in rocky areas on limestone in the foothills of the northern mountains, on the escarpment hills of central Oman, and on rocky coastal hills in Dhofar. *Altitude*: 150–1900 m. Elsewhere in the Arabian Peninsula found in UAE, Yemen.

Distribution map & Illustration: 565.

Notes: The species is common in Dhofar but is known from a single locality in Central Oman and at a few localities in northern Oman. It shows great variations in the colour, size and number of flowers in the inflorescence. Like the others succulent members of this group, this species is also at risk from collectors and developmental projects especially road building. On the National Red List this species is assessed as Vulnerable [VU A4 (c)], based on a projected population reduction and a decline in the quality of habitat. Recent information shows that there is quarrying at one of the locations in the Hajar range, which will definitely affect the *flava* population. Proper measures should be taken to conserve this species.

The whole plant is edible, but the stems get bitter near the base.

5. ***Desmidorchis tardellii*** Mosti & Raffaelli, Webbia 59(2): 285 (2004).
Type: Oman, Dhofar, Raysut, 30 m, 16 Sep. 2003, *M. Raffaelli, M. Tardelli & S. Mosti* s.n. (holotype FT).
Vernacular names: zoja, izdot (Jibbali); duru el kebeh (Dhofari Arabic).

Description: Clump-forming succulent perennial herb up to 50 cm across; stems succulent, up to 40 cm, branching from the base and above, 4-angled in cross-section, 1.5–2 cm in cross section, angles irregularly triangular rounded, with white callus scars on the tips, grey-green to purple-brown to red-tinged in colour. Flowers in apical umbellate inflorescences of 35–60 flowers, sweet smelling; pedicels 2.5–3.5 cm. Calyx 5-lobed almost to base, lobes 2–3 mm, narrowly triangular, reddish-brown. Corolla creamy-white, cup-shaped at base, 5-lobed; lobes spreading, 6–8 mm, narrowly triangular, acute; corona pale yellow, in 2 series: outer corona lobes erect, bifid to the base with 2 narrow segments 1.5–2 mm long; inner lobes obtuse, incumbent over the staminal column. Pollinia solitary in each anther locule, ascending. Follicles paired, erect, 10–12 cm, narrowly ovoid, acute, glabrous. Seeds with a tuft of white hairs at the tip.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the low rocky coastal hills and low coastal plains, wadi sides and on foothills of the south-facing coastal mountains; endemic. *Altitude*: 30–850 m. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 566.

Notes: This species has been included in *D. flava* as a variant form with white pedicellate flowers by various botanists working in this region. Forms with pale yellow flowers, fewer-flowered umbels and shorter pedicels are also known, especially in the eastern Hajar

mountains of Northern Oman. However this is quite a distinct species, found mainly on coastal areas and in all respects a good species. The conservation status of this species is here assessed as Vulnerable [VU A4(c)], based on a projected population reduction and a decline in the quality of its habitat.

6. ***Desmidorchis penicillata*** (Deflers) Plowes, Haseltonia 3: 58 (1995).
Basionym: *Boucerosia penicillata* Deflers (1889). *Synonym*: *Caralluma penicillata* (Deflers) N.E.Br. (1892).
Vernacular name: jid (A)

Description: Clump-forming succulent perennial herb; stems grey-green, leafless, up to 1 m, branching from base, tapering above, ± 4 cm in diameter, angled; old stems recurved. Inflorescence subapical with up to 15 flowers in umbels, with a faint smell; pedicels up to 10 mm. Corolla rotate, greenish-yellow with the inner surface of lobes papillose; papillae green to purplish, sometimes with purple spots, tips of lobes with purple cilia. Corona green or reddish-brown; outer surface glabrous, inner surface pubescent, hairs whitish; outer lobes bifid, forming 2 short erect teeth; inner lobes with short lobes just touching the anthers. Follicles erect, 6–8 cm, ovoid, acute, glabrous. Seeds with a tuft of white hairs at the tip.

Flowering and fruiting: April to August.

Distribution and habitat: Northern Oman, including Musandam, in the western Hajar mountains, in sandy depressions amongst stones and rocks. *Altitude*: 1300–2000 m. Distributed in NE Africa and Southern Arabia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 567.

Notes: The species occurs in the Jebal Akhdar range (western Hajar mountains) and was recently recorded on the summit of Jebel Harim, Musandam; it is known so far from a few localities where no more than 20 individuals exist at each location. The population has declined in numbers at two of these localities (my observations in 2004). On the National Red List this species is assessed here as Critically Endangered [CR A2], based on its small population and development pressure, especially building road and hotels on this mountain. Careful monitoring and complete ban on the collection of live material is necessary for the conservation of this species in Oman.

7. ***Desmidorchis acutangula*** Decne., Ann. Sci. Nat., Bot. sér. 2, 9: 265 (1838).
Type: Senegambia (P, destroyed); neotype: Mali, *de Wally* 4872 (P).
Synonyms: *Boucerosia acutangla* (Decne.) Decne. (1844); *Boucerosia russeliana* Brongn. (1860); *Caralluma retrospiciens* Ehrenb. ex N.E.Br. (1904); *Caralluma retrospiciens* Ehrenb. ex N.E.Br. subsp. *tombuctuensis* (A.Cheval.) A.Cheval. (1934); *Caralluma retrospiciens* Ehrenb. ex N.E.Br. var. *acutangula* (Decne.) White & Sloane (1937); *Caralluma russeliana* (as russelliana) (Brongn.) Cufod. (1969). [For full synonomy see Meve & Liede (2002) & Gilbert's account in *Fl. Ethiopia & Eritrea*: 2003].

Description: Clump-forming succulent perennial herb forming large clumps; stems becoming woody at base, up to 1.5 m (Yemen plants) branching from the base and above, conspicuously 4-angled, rib margins dentate, the angles thin and flattened, appearing H-shaped in cross-section, grey-green. Leaves ovate. Flowers in apical umbellate inflorescences of many flowers, 5–10 cm across; pedicels ± 4.5 cm. Calyx 5-lobed almost to base, lobes narrowly triangular. Corolla dark brown to black-purple, not fleshy, 20–30 mm across, rotate, 5-lobed to half the length, strongly rugulose, glabrous to densely pubescent; lobes spreading, ovate, acute; corona in 2 series: outer corona lobes dark purple, erect, bifid to the base with 2 narrow segments, pubescent; inner lobes incumbent over the staminal column. Pollinia solitary in each anther locule, ascending. Follicles paired. Seeds with a tuft of white hairs at the tip.

Flowering and fruiting: September/October.

Distribution and habitat: Southern Oman, Dhofar, on the low dry rocky hills, and wadi banks. *Altitude*: ± 350 m. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 568.

Notes: This is quite a distinct species, but is known from only a single location in Dhofar. On the National Red List this species is assessed as Endangered [EN B2(a)], due to its narrow distribution range, being found at a few locations, and continuing decline in the quality of habitat.

8. ***Desmidorchis awdeliana*** (Deflers) Meve & Liede, Plant Syst. Evol. 234: 202 (2002).
Type: Yemen, Nakha Mt., close to Bilad Awdeli, *Deflers* 485 (holotype P).
Basionym: *Boucerosia awdeliana* Deflers (1896). *Synonyms*: *Caralluma awdeliana* (Deflers) Berger (1910); *Crenulluma awdeliana* (Deflers) Plowes (1995).

Description: Clump-forming succulent perennial herb with erect to ascending stems; stems grey-green, leafless, up to 30 cm, branching from base; stems angled, 8–13 mm across, angles rounded. Inflorescence apical, with up to 15 flowers in umbels, with a faint smell; pedicels 6–10 mm. Corolla rotate, yellow, the inner surface of lobes with dark purple spots, ± 10 mm in diameter, tips recurved; tube 10–13 mm long. Corona green or reddish-brown; outer surface glabrous, inner surface pubescent, hairs whitish; lobes erect, filiform. Follicles erect, 8–10 cm, ovoid, acute, glabrous (not seen).

Flowering and fruiting: September/October.

Distribution and habitat: Southern Oman, Dhofar, recorded so far from a single locality in the drier part, on the low dry wadi banks, amongst rocks and stones. *Altitude*: ± 350 m. Elsewhere in the Arabian Peninsula found in Yemen, but not recorded by Wood (Fl. Yemen: 1997).

Distribution map & Illustration: 569.

Notes: First recorded by Collenette from Ayun, illustrated in Asklepios 83: 23, f. 14, 15

(2001). A collection by McLeish from the same location identified as "*tuberculata*", is referable to *D. awdeliana*.

NEW RECORD FROM OMAN

Desmidorchis lavranii (Rauh & Wertel) Meve & Liede, Pl. Syst. Evol. 234: 202 (2002). Recorded from Southern Oman, Dhofar, from Jebal Qamar – a small population of two individuals. (Patzelt et al., Edinb. J. Bot. 71: 168, 2014). A regional endemic found elsewhere in Yemen.

19. **Monolluma** Plowes

Five species distributed in NE Africa, Arabia and Soqotra.

Corolla lobes pale yellow, erect; corona dark yellow, outer corona absent; inner corona of 5, 3-lobed segments attached to the staminal column, lateral lobes erect, central lobe incumbent over the staminal column ..... 1. **M. quadrangula**

Corolla lobes greenish-white on the outside with red to brown to purple-brown wart-like spots on the lobes, purple-brown within, papillose, papillae reddish-brown; lobes ciliate or not; corona dark purple-brown, in 2 series; outer lobes deeply bifid; inner lobes incumbent on the anthers ..... 2. **M. hexagona**

1. ***Monolluma quadrangula*** (Forssk.) Plowes, Haseltonia 3: 65 (1995).

Basionym: *Stapelia quadrangula* Forssk. (1775). –Type: lecto(icono) type designated by Gilbert, 1990 of Forsskal 1776: Icon. Rer. Nat., t. 6. *Synonyms*: *Boucerosia quadrangula* (Forssk.) Decne (1844); *Caralluma quadrangula* (Forssk.) N.E.Br. (1892); *Echidnopsis quadrangula* (Forssk.) Deflers (1896); *Desmidorchis quadrangula* (Forssk.) Gilbert & Raynal (1980).

Vernacular names: zoja, serayn (Jibbali); sereyon (Dhofar Arabic).

Description: Clump-forming succulent perennial herb up to 50 cm across; stems succulent, up to 40 cm, branching from the base, 4-angled in cross-section, 1–3 cm in cross section, angles obtuse, with prominent white scars on the tips; stems grey-green or green in colour, with a pungent smell. Flowers 1–3, at the tips of stems, 12–15 mm across, fragrant; pedicels ± 5 mm. Calyx 5-lobed almost to base, lobes ± 2 mm, narrowly triangular. Corolla pale yellow, 5-lobed; lobes erect, 10–11 mm, ovate-triangular, margins reflexed; corona dark yellow; outer corona absent; inner corona of 5, 3-lobed segments attached to the staminal column, lateral lobes erect, central lobe incumbent over the staminal column. Pollinia solitary in each anther locule, ascending. Follicles paired, erect, 8–10 cm, narrowly ovoid, acute, green, glabrous. Seeds with a tuft of white hairs at the tip.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains and the summit plateau, in pockets of sand amongst rocks and stones. *Altitude*: 400–850 m.

Elsewhere in the Arabian Peninsula found in western Saudi Arabia and Yemen.

Distribution map & Illustration: 570.

Notes: An upland species, restricted in its distribution to the mountain areas of Dhofar. At present it is not uncommon in the upper and lower hills of the escarpment hills, however recent amenity developments and road building are a threat to this species. On the National Red List this species is assessed as Vulnerable [VU) B1 (b iii)], due to its narrow geographic range of distribution and continuing decline in the quality of habitat.

2. ***Monolluma hexagona*** (Lavranos) Meve & Liede, Plant Syst. Evol. 234: 203 (2002). *Basionym*: *Caralluma hexagona* Lavranos (1963). –Type: Yemen, Audhali Plateau, 3 miles S of Al Madhan, *Lavranos* 1829 (holotype K; isotype PRE). *Synonyms*: *Caralluma foulcheri-delboscii* Lavranos (1964); *Caralluma shadhana* Lavranos (1977); *Sulcolluma hexagona* (Lavranos) Plowes (1995).

Description: Clump-forming succulent herb; stems succulent up to 50 cm, 4–6-angled. Inflorescence of 3–10 flowers in subapical clusters. Pedicel 4–10 mm. Corolla rotate to campanulate, 12–22 mm in diameter, lobes greenish-white on the outside, with red to brown to purple-brown wart-like spots on the lobes, purple-brown within, papillose, papillae reddish-brown; lobes ciliate or not. Corona cupular, dark purple-brown; outer lobes deeply bifid; inner lobes incumbent on the anthers (description from Bruyns 1987).

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, in the foothills of Jebel Semhan. *Altitude*: ± 400 m. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen (SE).

Distribution map & Illustration: 571.

Notes: *M. hexagona* is somewhat similar to *M. quadrangula* in its morphology, but is only weakly related to it at the molecular level (Meve & Liede, 2002). H.A. Jonkers (pers. comm. 2009) states that … "Meve & Liede (2002) have shown that genetically *hexagona* and *Edithcolea grandis* are basally weakly joined with *Monolluma quadrangula* and *M. socotrana*, but whereas they retain *Edithcolea* as a genus, *hexagona* was assigned to *Monolluma*. With the three species *quadrangula*, *socotrana*, and *cicatricosa*, *Monolluma* can be coherently circumscribed as a 'solid' genus; however, with the inclusion of *hexagona* and *solenophora* there is no way of giving a useful generic diagnosis based on stem morphological characters, since *Monolluma* sensu Meve & Liede, now includes three erect shrubs, and two species with a decumbent and sprawling habit [rooting adventitiously], that lack the prominent pedicel scars of *quadrangula* e.s. As floral characters are not useful either, I would be inclined to keep *hexagona* in *Sulcolluma* Plowes …"

M. hexagona is rare in Oman, with its easternmost distribution in Dhofar. It is so far recorded only from the foothills of Jebel Semhan, where a very small population exists. A few individuals have disappeared in the last 5 years (1989–1992) from this location. On the National Red List this species is assessed here as Critically Endangered [CR A2 (a, c,

d)] based on its small population and development pressure on this mountain region in the last 10 years.

20. **Rhytidocaulon** Bally
Fifteen species distributed in Ethiopia, Kenya, Somalia and S Arabia.

Rhytidocaulon fulleri Lavranos & Mortimer, Nat. Cactus & Succ. Journ. 25(1): 2–4 (1970). Type: Oman, Dhofar, 14 Nov. 1963, 3000 ft., A.B.I. Fuller in *Fuller & Lavranos* 7133 (holotype PRE).
Vernacular names: dugebos, rayan (Jibbali as for *Echidnopis*).

Description: Prostrate, creeping to ascending succulent herb, more or less leafless, simple or few branched at base; main stem up to 20 cm and ± 2 cm thick, 4–5-angled, wrinkled with rounded tubercles, new growth bluish-green, older parts grey-green, covered with thick waxy coating. Leaves near the apex of stem, ± 3 mm, ovate, small and rudimentary, falling soon. Flowers shortly pedicellate, solitary or in pairs, 2.5–4.5 mm across. Calyx 5-lobed, lobes 2–3 mm, deltoid. Corolla 5-lobed, lobes free to the base, 4–10 mm, linear-spatulate, margins recurved, yellowish-brown with brownish-red transverse lines, connivent at the tips; corona in 2 series, brown-red, 2–4 mm across; outer lobes triangular with erect basal processes; inner lobes pinkish, oblong, inwardly directed. Pollinia ovoid. Fruit of paired follicles, erect, 40 × 4 mm, linear, bluish-green with reddish transverse markings.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, on Jebel Qamar, found under low shrubs on the seaward facing slopes of the escarpment mountains. *Altitude*: 100–1150 m. A regional endemic, elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 572.

Notes: The species is rare in Dhofar. It is only known from a few locations on Jebel Qamar and further east on Jebel Qara. One of the populations has disappeared from at least one of locations since 1995. The plant is curious looking and is sought after by collectors and succulent enthusiasts. On the National Red List this species is assessed here as Critically Endangered [CR A2 (a, c, d)] based on its small population and development pressure on this mountain region in the last 10 years.

21. **Echidnopsis** Hook.f.
Some 19 species distributed from Tanzania north to S Arabia.

Echidnopsis scutellata (Deflers) A.Berger, Stap. u. Klein.: 26 (1910).
Basionym: *Caralluma scutellata* Deflers (1896).
subsp. ***dhofarensis*** Bruyns, Bradleya 6: 18 (1988).
Type: Oman, Dhofar, on road from Thamrait to Salalah, Agabat al Hatab, 700 m, 4 Oct. 1979, *A.G Miller* 2811 (holotype E).

Synonym: *E. planiflora* Bally sensu Miller & Morris (1988).
Vernacular names: degubsi, dugebos (Jibbali).

Description: Small perennial herb; stems succulent, procumbent to ascending, unbranched, up to 20 cm long and ± 10 mm in diameter, many-angled and covered with rounded to conical tubercles, pale to vivid green, rooting where stem touches the ground. Rudimentary leaves present on the tubercles, soon falling. Flowers arising singly near the apex of stems, 9–10 mm across, sessile to shortly pedicellate. Calyx 5-lobed, lobes ± 2 mm, triangular. Corolla yellow, broadly campanulate, 5-lobed, flat when fully opened; lobes ± 4 mm, deltoid-ovoid, usually with reflexed tips, margins reflexed; walls of the corolla lobes adpressed to the staminal column; corona reddish or yellow, of 2 series: outer lobes divided near middle and flattened on upper surface; inner lobes with flat base, exceeding the anthers and connivent above the staminal column. Follicles paired, erect, ± 4 cm, narrow ovoid, acute at apex, grey-green marked with brownish transverse markings.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, in scattered locations on the escarpment mountains, growing under shrubs of *Euphorbia balsamifera*. *Altitude*: 800–1300 m. Not recorded elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 573.

Notes: The species is not commonly found in Dhofar; so far all plants that I have seen belong to this subspecies, but it is possible that the type subsp. *scutellata* also occurs there. *Echidnopsis scutellata* subsp. *dhofarensis* is assessed here as Endangered [EN A2 (a, c, d)] on the National Red List, based on its small fragmented populations and degradation of habitat from development and roads on this mountain region.

22. **Anomalluma** Plowes
Two species distributed in Somalia, Yemen and Oman.

Anomalluma mccoyi (Lavranos & Mies) Meve & Liede, Plant Syst. Evol. 234: 204 (2002).
Type: Oman, Dhofar, near Mirbat, 80 m, *T. McCoy* 2305 (holotype MO).
Basionym: *Pseudolithos mccoyi* Lavranos & Mies (2001).

Description: (From Lavranos & Mies in Asklepios 82: 29 (2001)). Perennial succulent herb, branching from a large subterranean tuberous base; stems erect to less often decumbent, angled, rooting adventitiously, 12–40(–70) mm, 4–8 mm across, irregularly tuberculate-bullate, greyish or brownish, glabrous; latex clear. Leaves minute, soon falling. Flowers 2–3 together, near the apex, opening successively; pedicels 2–3 mm. Calyx 5-lobed to base, lobes ± 1 mm, triangular. Corolla dark olive-green with purple-brown spots, less often dark reddish-brown, rotate, 7 mm in diameter, 5-lobed, glabrous; lobes ± 2 mm, ovate, margins slightly revolute; corona very dark brown, of 2 series: outer lobes ± 1 mm, with 2 short ascending segments, truncate; inner lobes flattened, strap-shaped, slightly broader towards

the apex, rounded or slightly indented, connivent horizontally over the staminal column. Follicles paired, 20–30 mm, fusiform, brownish-grey with longitudinal dark stripes and blotches, divergent at about 30°.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, in the foothills of the escarpment mountains. *Altitude*: 80 -100 m. Elsewhere in the Arabian Peninsula found in Yemen (S).

Distribution map & Illustration: 574.

Notes: Lavranos & Mies in Asklepios 82: 27 (2001) include *Miller* 9376, previously thought to represent *Pseudolithos dodsonianus* [Bruyns & Meve, Edinb. J. Bot. 52(2): 195–203, 1995], in their new species *P. mccoyi*, and thus there is just a single species present in Oman [also Yemen], with *A. dodsoniana* being restricted to Somalia (H.A. Jonkers, pers.comm. 2009).

Rare and localised in its distribution, recorded from a few locations near Mirbat. On the National Red List this species is assessed as Critically Endangered [CR A2 (c, d)], based on its small population, grazing pressure and development of track roads in the area.

23. **Orbea** Haw. *nom. cons.*
Pachycymbium L.C.Leach (1978); *Angolluma* R.Munster (1990).
About 56 species distributed from South Africa, tropical east and central Africa through to Angola and Namibia, and NE Africa to Morocco and SW Arabia.

Stems decumbent; corolla lobes 9–10 mm, erect to spreading, reddish-brown or yellow suffused with brown ..... 1. **O. nardii**
Stems decumbent to erect; corolla lobes 16–17 mm, ascending to connivent, greenish-yellow below the middle, purple-red above and along the margins ..... 2. **O. luntii**

1. ***Orbea nardii*** Raffaelli, Mosti & Tardelli, Webbia 63(2): 162 (2008).
Type: Oman, Dhofar, coastal road beyond Al Mughsayl, 10 Sep. 2002, *M. Raffaelli, M. Tardelli, S. Mosti* s.n. (holotype FT).
Synonyms: *Orbea wissmannii* var. *parviloba* Bruyns (2001). - Type: Yemen, Jebel Raymah, 21 Mar.1984, *Miller & King* 5336 (holotype E); *Orbea parviloba* (Bruyns) Meve (2009; comb. illeg. Art. 11.2).
Vernacular names: er awiyan (Jibbali); re wiyon (Dhofar Arabic).

Description: Perennial succulent leafless herb, forming small clumps; stems decumbent, up to 8 cm, simple or with few branches, 4-angled with soft conical spines on the angles 4–6 mm long, joined at the bases, stems excluding soft spines ± 2 cm in cross section, glabrous, green to grey-green marked with dark green to purplish-green markings. Flowers 1–5, near or at the tips of branches; pedicels 2–4 mm, ascending to erect. Calyx 5-lobed almost to base, lobes 3–4 mm, lanceolate, acute. Corolla 5-lobed to base; lobes erect to spreading, 9–10 mm, narrowly lanceolate, margin strongly revolute and touching each other, red-

dish-brown or yellow suffused with brown, white puberulous within or sparsely puberulous near the base; corona ± 2 mm long, yellow, in two series; outer lobes forming a pouch, with apex of lobes spreading and forming a truncate to emarginate spur below the inner corona lobes; inner lobes flattened, emarginate, adpressed to backs of anthers and rarely exceeding. Staminal column yellow; pollinia ovoid. Follicles (not seen).

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar on slopes of the escarpment mountains, amongst rocks and stones, below shrubs. *Altitude*: 500–1150 m. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 575.

Notes: *O. nardii* and *O. luntii* (in Oman) belong to a group of species in the "baldratii-luntii group" characterized by the strongly revolute, deeply lobed, smooth or finely pubescent corolla-lobes, distributed in Saudi Arabia, Yemen and Oman. *O. wissmannii* is a very variable species where Bruyns recognises three varieties: var. *wissmannii*, var. *parviloba* (now *O. nardii*) and var. *eremastrum* (O.Schwartz) Bruyns. The difference between var. *wissmannii* and var. *parviloba* is in the length of the corolla lobes and the length of the gynostegium (corolla lobes < 10 mm, gynostegium < 2 mm long in *parviloba*; corolla lobes > 12 mm, gynostegium > 3 mm tall in *wissmannii*). (*O. nardii* differs furthermore in flower colour, indumentum and a white [not yellow] corona; see Meve, Asklepios 105, 2009; note that on p. 21 "6–12 mm long" [of the hairs] should read 0.6–1.2 mm). Var. *eremastrum* differs in its corolla lobes that are slightly revolute, but in other respects is similar to *O. wissmannii*. Var. *wissmannii* and var. *eremastrum* have so far been recorded from Saudi Arabia and Yemen and var. *parviloba* from Oman and Yemen. *O. luntii* previously not known from Oman is now recorded there.

In Oman *O. nardii* is rare being recorded at a few locations on the slopes of Jebel Qamar and Jebel Semhan. On the National Red List this species is assessed here as Critically Endangered [CR A2 (c, d)] based on its small population, grazing pressure and the rapid development of the areas where the species is recorded.

2. ***Orbea luntii*** (N.E.Br.) Bruyns, Aloe 37(4): 75 (2001; dated 2000).
Type: Yemen, Hadhramaut (Hadramawt), hills near Dobaibah, Feb. 1894, *Lunt* 209 (holotype K).
Basionym: *Caralluma luntii* N.E.Br. (1894). *Synonyms*: *Pachycymbium luntii* (N.E.Br.) M.G.Gilbert (1990); *Angolluma luntii* (N.E.Br.) Plowes (1994).

Description: Perennial succulent herb, forming small clumps; stems decumbent to ascending, up to 15 cm, simple or with few branches, 4-angled with soft conical spines on the angles 3–10 mm long, joined at the bases, stems excluding soft spines ± 1 cm in cross section, glabrous, green marked with purple markings. Flowers 1–2, near or at the tips of branches; pedicels 10–12 mm, ascending to erect. Calyx 5-lobed almost to base, lobes 2–4 mm, lanceolate, acute. Corolla 5-lobed to base; lobes ascending to connivent, 16–17 mm, narrowly

lanceolate, margin strongly revolute and touching each other, greenish-yellow below the middle, purple-red above and along the margins, glabrous to minutely puberulous; corona ± 4 mm long, in two series; outer lobes forming a pouch, with apex of lobes spreading slightly; inner lobes flattened, emarginate, adpressed to backs of anthers and exceeding to meet in centre. Staminal column purple; pollinia ovoid. Follicles (not seen).

Flowering and fruiting: September/October (vegetative material collected in September, flowered in October).

Distribution and habitat: Southern Oman, Dhofar, in the escarpment mountains, below shrubs, amongst rocks and stones. A regional endemic elsewhere in the Arabian Peninsula found in Yemen. *Altitude*: 500–1000 m.

Distribution map & Illustration: 576.

Notes: The species in uncommon throughout its range of distribution. In Oman it is known from a single location on Jebel Qamar. On the National Red List it is assessed as Critically Endangered [CR A2 (c, d)] due to its small population and rapid development and road building in the area where this species is found. Not easy to distinguish from *O. nardii* in the vegetative state.

NEW RECORD FOR OMAN

Oxystelma esculentum (L.f.) Sm., Cycl. 25: (unnumbered) 1813.
Basionym: *Periploca esculenta* L.f. (1781 publ. Apr 1782).
Known for a single location from Oman in the Eastern Hajar mountains, Wadi Al Arbeyn, village Suwayh (*Patzelt et al.* 3990, Oman Botanic Garden Herbarium). Ref.: Patzelt et al., Edinb. J. Bot. 71: 167, 2014.

72. **Solanaceae**

by Ghulam Sarwar[1]

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Key to the genera of Solanaceae in Oman

1. Fruit a capsule 2
   Fruit a berry (sometimes dry but never dehiscent) 3

[1] Sadly, Ghulam Sarwar passed away in June 2012 in Karachi, Pakistan. The account is completed by Shahina A Ghazanfar

2. Flowers solitary, actinomorphic; capsule spiny, with a basal circular rim, dehiscing longitudinally ..... 5. **Datura**
   Flowers in racemes, zygomorphic (corolla somewhat 2-lipped); capsule smooth, dehiscing by an apical lid ..... 7. **Hyoscyamus**
3. Flowers 2-many, congested in leaf axils; corolla greenish-yellow and whitish-green ..... 4. **Withania**
   Flowers solitary in leaf axils; corolla blue, white or yellow 4
4. Fruiting calyx sagittate at base ..... 6. **Nicandra**
   Fruiting calyx rounded, not sagittate at base 5
5. Fruiting calyx enlarged, inflated and enclosing the fruit; berry juicy ..... 3. **Physalis**
   Fruiting calyx not inflated 6
6. Corolla funnel-shaped or campanulate; anthers not connivent ..... 1. **Lycium**
   Corolla rotate; anthers connivent ..... 2. **Solanum**

1. **Lycium** L.

About 100 species, distributed in South America, Africa, Europe, Asia and Australia.

Lycium shawii Roem. & Schult., Syst. Veg. 4: 693 (1819).

Synonyms: *Lycium persicum* Miers (1854). Type: Yemen, Aden, 1837, collector unknown, s.n. (syntype K); *L. arabicum* Schweinf. ex Boiss. (1879).

Vernacular names: qasad, semkis, semkos, senkot, awzak.

Description: Large perennial shrub up to 2 m; stems branched, whitish, lateral stems short, ending in sharp points. Leaves alternate or clustered, somewhat succulent, 4–23 × 2–6 mm, obovate to elliptic-oblong, base cuneate, apex acute or obtuse, margins entire, puberulous to tomentose, greyish-green. Flowers axillary, solitary; pedicels 3–8 mm long. Calyx persistent, 2–4 mm, tubular, 5-lobed; lobes 0.5–1 mm, acute, pubescent. Corolla white or pale pink or pale purple, 10–16 mm, funnel-shaped, 5-lobed; lobes 1–2 mm, acute, minutely pubescent. Anthers about in the mouth of the corolla tube, dehiscing by longitudinal slits. Style 8–14 mm, exserted; stigma capitate. Berry orange-red, 3–4 mm in diameter, globose, many-seeded.

Flowering and fruiting: March to August.

Distribution and habitat: Throughout Oman, in the foothills and low altitudes of the mountains, rocky hillsides, central gravel plains, and in moderately sandy saline habitats; common. *Altitude*: 150–1700 m. Distributed in N & E Africa, through eastern Africa to South Africa and Swaziland, Mediterranean Europe, Turkey, Iraq, Iran, Arabia, Pakistan and western India. Elsewhere in Arabian Peninsula found in Bahrain, Qatar, Kuwait, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 577.

Notes: Common throughout Oman, and often badly over-grazed, but does recover if left

alone by livestock. In traditional medicine the fruit and soft growing tips were pounded together and an extraction made to relieve colic, and also taken to improve the sharpness of sight.

2. **Solanum** L.

About 1500 species, cosmopolitan in distribution, but mainly in subtropical Central and South America, and then in Africa and Australia.

1. Plants armed; indumentum stellate 2
   Plants unarmed; indumentum simple, not stellate 3
2. Stem glabrous or glabrescent; berries black ..... 1. **S. nigrum**
   Stem pubescent with long hairs; berries red or orange ..... 2. **S. villosum**
3. Leaves orbicular to subcordate; leaves and petiole smooth, without prickles ..... 3. **S. cordatum**
   Leaves ovate to broadly ovate, elliptic-oblong or ovate-lanceolate 4
4. Stamens unequal, one filament longer than the rest; fruit dry ..... 5. **S. coagulans**
   Stamens equal; fruit fleshy 5
5. Leaves ovate to broadly ovate with sinuate margins ..... 4. **S. incanum**
   Leaves deeply lobed, lobes with sinuate margins ..... 6. **S. virginianum**

1. ***Solanum nigrum*** L., Sp. Pl. 186 (1753).

Vernacular name: shejarat al gharub. *Common English name*: black nightshade.

subsp. **nigrum**

Description: Annual herb, up to 60 cm tall; stems branched, erect, glabrescent to pubescent. Leaves alternate, 13–35 × 8–18 mm, ovate to lanceolate, base cuneate, apex acute to obtuse, margin entire to coarsely dentate; petiole 7–30 mm. Flowers axillary, in 4–7-flowered cymes; pedicels 7–10 mm long, recurved in fruit. Calyx 2–3 mm, campanulate; lobes 1–2 mm, ovate, apex obtuse; fruiting calyx 4–5 mm, not enclosing the fruit. Corolla white or tinged purple, 5–8 mm, rotate, with spreading lobes. Anthers 1–3 mm, oblong, connivent, dehiscing by apical pores. Style 2–3 mm; stigma capitate. Berry 4–8 mm across, ± globose, deep purple to black. Seeds 1–2 mm broad, discoid, reddish-brown.

Flowering and fruiting: More or less throughout the year.

Distribution and habitat: Throughout Oman, in cultivated and irrigated areas, near water in wadis and farms. *Altitude*: 10–1800 m. Possibly native to Eurasia, now widespread in most parts of the world except the polar regions. Elsewhere in Arabian Peninsula found in Bahrain, Qatar, Kuwait, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 578.

Notes: In traditional medicine, the berries were crushed and mixed with oil and used to dye the skin for protection against the cold and illnesses associated with cold and wet weather.

2. ***Solanum villosum*** Mill., Gard. Dict. ed. 8. no. 2 (1768).
Synonyms: *Solanum humile* Bernh. ex Willd. (1809); *S. nigrum* var. *humile* (Bernh. ex Willd.) C.Y.Wu & S.C.Huang (1978).

subsp. ***miniatum*** (Bernh. ex Wild.) Edmonds (1984).
Basionym: *S. miniatum* Bernh. ex Willd. (1809).

Description: Annual erect herb, up to 25 cm high, pubescent; stems with few branches, sparsely pubescent to glabrous. Leaves alternate, 30–60 × 15–40 mm, ovate, elliptic or lanceolate, apex acute, base cuneate, margins entire to coarsely dentate, glabrous to ± pubescent; petiole slender, up to 50 mm. Flowers axillary, in 3–6 flowered cymes; peduncle 5–10 mm long; pedicel 4–5 mm long. Calyx 1–2 mm, campanulate, 5-lobed, lobes 1–1.5 mm, obtuse; fruiting calyx 2–3 mm, not enclosing the fruit. Corolla white, 4–5 mm, sometimes drying yellow, rotate, apex acute. Anthers 1–2 mm, oblong, connivent, dehiscing by apical pores. Fruit (berry) 5–8 mm in diameter, globose, red or orange. Seeds 1–2 mm broad, discoid.

Flowering and fruiting: March to April; October to November.

Distribution and habitat: Northern and Southern Oman, mountain wadis, and on the escarpment mountains in Dhofar, beside roads. *Altitude*: 300–1800 m. Distributed in Europe, SW Asia to S Asia, China, India and Nepal. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 579.

3. ***Solanum cordatum*** Forssk., Fl. Aegypt.-Arab. 47 (1775).
Type: Yemen, *Forsskal* s.n. (not found); Neotype: Yemen (N), by a water course in Naqil Khailan between Beni Harath and Nehm, northeast of Sana'a, 12 May 1978, *J.R.I.Wood* 2327(K).

Description: Scrambling undershrub, up to 70 cm, stellately pubescent; stems branched, unarmed or sometime with small prickles. Leaves alternate, or clustered on short shoots, 6–21 × 7–20 mm, orbicular-oblong to subcordate, base obtuse, apex obtuse, margins entire, stellately pubescent; petioles 5–15 mm. Flowers 1–2, axillary or terminal; pedicels 10–18 mm. Calyx 3–5 mm, campanulate; lobes 2–4 mm, apex acute to obtuse, stellately pubescent; fruiting calyx not enclosing the fruit. Corolla 4–6 mm, purple, rotate; lobes 3–5 mm long, acute to obtuse, stellately pubescent. Anthers 3–4 mm, oblong, connivent, dehiscing by apical pores. Stigma slightly exceeding the anthers; style 5–7 mm. Berry 4–7 mm in diameter, globose, orange to yellow-red. Seeds 1.5–2.5 mm broad, subreniform, verrucate.

Flowering and fruiting: July to September.

Distribution and habitat: Southern Oman, Dhofar, on slopes of mountains, in grassland, and in wadis, in *Acacia–Commiphora* woodland. *Altitude*: 750–1200 m. Distributed in

Ethiopia, Somalia, Pakistan and India. Elsewhere in Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 580.

4. ***Solanum incanum*** L., Sp. Pl. 188 (1753).
Vernacular names: helkem, hukut, sharinjiban.

Description: Shrubs up to 1 m high; stems branched, prickly with hooked prickles, tomentose with stellate hairs. Leaves alternate, greyish-green, 5–11 × 2.5–8 cm, ovate to broadly ovate, base often unequal, cordate or rounded, apex obtuse, margins sinuate, prickles yellowish, whitish stellate-hairy on both surfaces. Inflorescence of 3–5-flowered cymes, with one bisexual basal flower near the stem and other functionally male flowers along the rachis; pedicel 10–15 mm long, densely prickly, elongating in fruit. Calyx 8–12 mm long, densely floccose, prickly, 5–lobed; lobes ± 7 mm, lanceolate, persistent. Corolla pale to dark purple, 10–20 mm, rotate, 5-lobed; lobes 5–10 mm, acute. Anthers 3–4 mm, oblong, connivent, dehiscing by apical pores. Style 10 mm; stigma capitate. Berry hard, 10–16 mm in diameter, globose, green, ripening yellow, many-seeded; fruits persisting for a long time on the plant. Seeds ± 2 mm, suborbicular, minutely reticulate, pale brown.

Flowering and fruiting: September to February.

Distribution and habitat: Throughout Oman, (including Musandam), on foothills and in wadis, hill slopes, rocky gorges, disturbed and waste ground, along track roads, and in irrigated and cultivated places. *Altitude*: 250–1000 m. Distributed in Ethiopia, Sudan, Egypt, Syria, Iraq, Iran, Afghanistan, Pakistan and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 581.

Notes: A widespread plant in Oman whose dominance indicates over-grazing in an area. In traditional medicine, a paste of fruits was used to remove hairs from hides, and smoke from seeds was used to treat toothache. A paste of the roots, leaves or fruit was used as a poultice to treat bruised fingers and toes and an infusion of the plant was drunk as a remedy for indigestion and to treat epileptic fits.

Wild collected seed of this species from Oman is held at the Millennium Seed Bank at Wakehurst Place, Royal Botanic Garden, Kew.

5. ***Solanum coagulans*** Forssk., Fl. Aegypt.-Arab. 47 (1775).
Type: Yemen, Wadi Mawr, *Forsskål* 409, 410 (syntypes C).
Synonym: *Solanum dubium* Fresen. (1833).

Description: Annual or perennial woody herb; stems whitish-green, branched, ± erect, upper parts covered with long and short prickles, pubescent with greyish stellate hairs. Leaves alternate, 3–10 × 1.4–5 cm, ovate-lanceolate, shallowly lobed, lobes irregular, rounded, base subcordate, stellate-hairy on both surfaces, prickles present on midrib above and be-

low; veins prominent underneath; petioles 1–6 cm, prickly. Inflorescence cymose, 6–10 flowered; pedicel 7–15 mm. Calyx 8–10 mm, campanulate, deeply 5-lobed; lobes 3–4 mm, lanceolate, acute, densely hairy, prickly below. Corolla purple, 10–12 mm long, rotate, 5-lobed, lobes spreading to reflexed. Stamens unequal, anthers 4–5 mm long, ± 8 mm for the longer one. Fruit yellow, dry, papery, ± 10 mm in diameter, globose, stellate- hairy at the apex. Seeds black, shiny.

Flowering and fruiting: February.

Distribution and habitat: Northern Oman, as a weed of irrigated crops. *Altitude*: ± 20 m. Distributed in E Africa, Sudan, Somalia, Ethiopia. Elsewhere in Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 582.

Notes: This species is recorded as a frequent weed of cultivated areas, but I have not seen any recent collections. It is recorded from two collections from northern Oman dating back to 1899, *Jayaker* s.n. (BM), and a more recent one collected in Feb. 1973, *Parker* 0.151 (BM). It is likely to be present in and around the Salalah area but I have not seen any collections from the Dhofar region either. Recorded more recently from the high plateau on the Eastern Hajar mountains (Patzelt et al., Edinb. J. Bot. 71: 167, 2014).

6. ***Solanum virginianum*** L., Sp. Pl. 1: 187 (1753).
Synonyms: *Solanum surattense* Burm.f. (1768); *S. xanthocarpum* Schrad. (1795).

Description: Prostrate annual herb with long yellow prickles; stems branched, glabrous or pubescent. Leaves 20–70 × 10–39 mm, elliptic-oblong, deeply pinnately lobed, lobes with sinuate margins, with many yellow prickles; petiole 10–35 mm, prickly. Flowers in 2–4-flowered cymes; pedicel 7–10 mm long. Calyx 3–5 mm, campanulate, 5-lobed, lobes 2–3 mm, acute, prickly. Fruiting calyx not enclosing the berry. Corolla purple, 10–12 mm, rotate, purple, 5-lobed, lobes 5–7 mm. Anthers 4–5 mm long, oblong, connivent, dehiscing by apical pores. Berry 10–15 mm in diameter, globose. Seeds 1–1.5 mm, discoid.

Flowering and fruiting: September to April.

Distribution and habitat: Northern and southern Oman; in Dhofar on the mountains; in northern Oman, recorded from the gravel plains in the foothills of the Hajar mountains. *Altitude*: 20–150 m. Distributed in Africa, S and SE Asia, Australia, Polynesia. Elsewhere in Arabian Peninsula found in Saudi Arabia, UAE.

Distribution map & Illustration: 583.

3. **Physalis L.**

About 90 species, native to temperate to subtropical America, widespread in Europe, Australia and Asia.

Physalis angulata L., Sp. Pl. 1: 183 (1753).
Synonym: *Physalis minima* auctt. non Linn. (1753); Ghazanfar, Ann. Cat. Vasc. Pl. Oman: 109 (1992).

Description: Annual herb up to 60 cm; stems branched, prostrate to erect, glabrous to pubescent. Leaves alternate, 2–11 × 0.8–6 cm, ovate to ovate-lanceolate, base cuneate, apex acute, margins entire, sinuate or irregularly dentate; petiole 0.7–7 cm. Flowers solitary, axillary at nodes; pedicel 5–12 mm. Calyx 2–3 mm, campanulate, pubescent, apex acute, ciliate. Fruiting calyx 1.5–2.3 × 1.2–2.5 cm, subglobose or ovoid, lobed to almost half its length, veined, membranous, pale green to brownish, inflated. Corolla 5–7 mm, funnel-shaped to campanulate, pale yellow. Anthers ± 2 mm. Style slightly exceeding the anthers; stigma capitate. Berry yellow, 8–15 × 6–10 mm, globose, enclosed in the persistent calyx.

Flowering and fruiting: August to September.

Distribution and habitat: Northern and Southern Oman, on the plains, in cultivated, irrigated and disturbed areas, near farms. *Altitude*: 10–250 m. Native of South America, now found in North Africa, through Arabia, Iran, Afghanistan, Pakistan, India to China and Nepal. Elsewhere in Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 584.

Notes: *Physalis angulata* is based on a collection from India "Habitat in India utraque", Herb. Linn. 247.9 (LINN lectotype). Friis (op. cit., 152) notes that there is some confusion whether *P. minima* L. and this species are distinct and as to where they occur. I have followed Friis in his concept of *P. angulata* for the species found in Oman.

4. **Withania** Pauquy
About 10 species, distributed in N Africa, W Asia, S Europe and Arabia.

Plants with branched hairs; fruiting calyx membranous, enclosing the fruit ..... 1. **W. somnifera**
Plants with stellate hairs; fruiting calyx not membranous, not enclosing the fruit ..... 2. **W. quaritica**

1. ***Withania somnifera*** (L.) Dunal in DC., Prodr. 13, 1:453 (1852).
Basionym: *Physalis somnifera* L. (1753). *Synonym*: *Withania somnifera* (L.) Dunal var. *communis* (Nees) Dunal (1852). Type: Yemen, *Schimper* 4 April 1836 (syntype P).

Description: Perennial herbs up to 1 cm high, with branched hairs. Stems erect, branched, woody. Leaves 4.5–9 × 2–6.5 cm, elliptic-ovate to broadly ovate, apex acute, base cuneate, margins entire; petiole 1–2.5 cm. Inflorescence cymose, 4–8-flowered; pedicel 2–3 mm long. Calyx 2–5 mm, campanulate, tomentose; lobes 1–2 mm, deltate. Corolla 4–7 mm, campanulate, yellowish-green; lobes 2–4 mm, ovate. Anthers 1 mm, yellow, ovoid. Styles

exserted; stigma capitate. Fruiting calyx 10–15 mm, membranous, urceolate, brown, globose or ovoid. Berry 4–8 mm in diameter, scarlet red, globose. Seeds 1.5–2 × 1–1.5 mm, brown, discoid-reniform.

Flowering and fruiting: More or less throughout the year.

Distribution and habitat: Throughout Oman, in sandy and rocky wadis, beside roads, near cultivations, and in disturbed and waste ground. *Altitude*: 40–1800 m. Distributed in SW Asia, Europe, Canary Islands, Mediterranean region, and Africa. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 585.

2. ***Withania quaritica*** A.G.Mill. & Biagi, Notes R.B.G. Edinb. 45(1): 68–70 (1988).
Type: Oman, Dhofar, cliff tops of Ras Hamar, 80 m, 8 Sept. 1985, *Miller* 7528 (holotype E; isotypes K, ON, UPS).
Vernacular names: genegeneh, mejoj.

Description: Perennial shrubby herb up to 1 m high, densely tomentose with whitish stellate hairs. Stems erect, branched, woody. Leaves 3–10 × 2–7 cm, ovate, apex acute to obtuse, base obtuse to truncate, margins entire. Petiole 1–5 cm. Flowers in 4–7-flowered cymes; pedicel 3–6 mm. Calyx 2–5 mm, funnel-shaped, tomentose; lobes 1–2 mm, triangular. Corolla 4–7 mm, campanulate, whitish-green; lobes 1–2 mm. Anthers ± 1 mm, oblong, yellow. Styles exserted; stigma capitate. Fruiting calyx 10–15 mm in diameter, globose, green. Berry 4–8 mm in diameter, globose, bright orange-red, surrounded by the persistent calyx. Seeds 2–3 × 1.5–2 mm, trigonous to somewhat reniform, yellowish-brown.

Flowering and fruiting: May to September.

Distribution and habitat: Southern Oman, Dhofar, growing on the escarpment mountains, on cliffs, with *Commiphora* spp., *Blepharispermum hirtum* and *Euphorbia jatrophoides*, in wet and shaded locations. *Altitude*: 50–150 m. A regional endemic also found in Yemen (S).

Distribution map & Illustration: 586.

5. **Datura** L.
About 11 species, distributed in South and North America, Australia, Pakistan, India and Arabia.

Plants glabrescent; calyx tubular; corolla white, yellowish or pale purple; capsule tuberculate or spiny, spines up to 3 mm long ..... 1. **D. fastuosa**
Plants densely pubescent; calyx cylindrical; corolla greenish, white at apex; capsule spiny, spines 5–11 mm long ..... 2. **D. innoxia**

1. ***Datura fastuosa*** L., Syst. Nat. ed. 10, 2: 932 (1759).
Synonym: *Datura metel* L. (1759).
Vernacular names: maranhah, benj, gumiguned, gumigunt *Common English name*: thorn apple

Description: Annual herb up to 2 m high, glabrescent. Stems branched, often dark purplish. Leaves 6–17 × 3.5–13 cm, ovate to broadly ovate, membranous, glabrescent, apex acuminate, base truncate or cuneate, unequal, margins irregularly sinuate-dentate, lobed or entire; petiole 1.5–6 cm. Flowers axillary, solitary; pedicel 0.5–1cm. Calyx 5–7 cm, tubular; lobes 1–2 cm. Corolla white, yellowish or pale purple, 15–18 cm, funnel-shaped. Anthers 0.8–1.2 cm. Style 13–16 cm; stigma capitate. Capsule 1.5–2.5 cm, deflexed, subglobose, tuberculate or spiny, spines up to 3 mm long. Seeds 0.2–0.3 mm in diameter, brown, reniform-discoid.

Flowering and fruiting: February to July.

Distribution and habitat: Throughout Oman, in the foothills of the northern and southern mountains, wadis, gorges, near water pools, edges of sandy desert near habitation, and often cultivated. *Altitude*: 50–1700 m. Distributed in tropical and subtropical regions of the Asia, Mediterranean, Africa and America. Elsewhere in Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 587.

Notes: Dried leaves and flowers have been used in traditional medicine for the treatment of asthma and breathing difficulties; ripe seeds have been used as an anaesthetic.

2. ***Datura innoxia*** Mill., Gard. Dict. ed. 8. no. 5 (1768).

Description: Annual herb, up to 2 m high, densely pubescent. Stems branched, greyish-green. Leaves 6–12 × 3–13 cm, ovate to broadly ovate, membranous, pubescent, apex acute, base truncate or cuneate, unequal, margins irregularly sinuate-dentate, lobed or entire; petiole 2–9 cm long. Flowers axillary, solitary; pedicel ± 1 cm. Calyx ± 9.5 cm, cylindrical; lobes ± 1 cm, acute. Corolla greenish, white at apex, ± 17.5 cm, funnel-shaped, apex acuminate. Anthers ± 1cm. Style ± 13.5 cm; stigma capitate. Capsule ± 3 cm in diameter, deflexed, globose, spiny with spines 5–11 mm long. Seeds 0.2–0.3 mm in diameter, brown, reniform-discoid.

Flowering and fruiting: March/April.

Distribution and habitat: Central Oman, in sandy places. *Altitude*: ±150 m. Distributed in C and S America, West Indies, western USA, Afghanistan, Pakistan, India. Elsewhere in Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 588.

6. **Nicandra** Adanson

A single species native to Peru, now widely naturalized in warmer regions or often cultivated.

Nicandra physalodes (L.) Gaertn. Fruct. Sem. Pl. 2: 237 (1791).

Basionym: *Atropa physalodes* L. (1753). *Common English name*: shoo fly.

Description: Annual or perennial herb up to 2 m high; stems branched, erect, angular, glabrous. Leaves alternate, 4–18 × 2–10 cm, ovate or elliptic, apex acute, base cuneate, margins lobed, sinuate-dentate, glabrescent; petiole 1–6 cm long. Flowers axillary, solitary; pedicel 1–2 cm. Calyx 0.6–20 mm, enlarging to 35 mm in fruit, 5-lobed; lobes ovate, apex acuminate, base sagittate. Corolla 12–18 mm, broadly funnel-shaped, purple or blue with a white centre. Anthers ± 2 mm, elliptic, dehiscing longitudinally. Fruiting calyx with prominent reticulate veins. Berry ± 15 mm in diameter, globose, pale brown when ripe.

Flowering and fruiting: September/October.

Distribution and habitat: Southern Oman, Dhofar, in the escarpment woodland, mostly in disturbed places. *Altitude*: ± 850 m. Native of Peru, widely naturalised in tropical America, Europe, Asia, and Africa. Naturalized in Oman.

Distribution map & Illustration: 589.

Notes: In recent years this species has spread to several locations on the Dhofar mountains, especially in the moist and wooded areas on Jebel Qara.

7. **Hyoscyamus** L.

About 20 species found in North Africa, Asia and Europe.

1. Leaves rounded to orbicular, base cordate; calyx up to 12 mm, villous .. 3. **H. flaccidus**
   Leaves obovate, or ovate to rhombic-ovate, base truncate or cuneate; calyx more than 12 mm long 2
2. Leaves crowded, obovate with entire margins; calyx papery in fruit ... 2. **H. gallagheri**
   Leaves ovate to rhombic-ovate with repand-sinuate or dentate margins; calyx not papery in fruit ..... 1. **H. muticus**

1. ***Hyoscyamus muticus*** L., Mant. Pl. 45 (1767).

Basionym: *Scopolia mutica* (L.) Dunal in DC. (1852). Type from Egypt and Arabia, plant grown in the Uppsala Botanical Garden from seed sent by Forsskål. *Synonyms*: *Hyoscyamus datora* Forssk. (1775); *H. insanus* Stocks (1852).

Vernacular names: benj, sakaran.

Description: Annual herb, up to 1 m; stems erect, branched, decumbent to erect, glabrous to pubescent, softly pubescent when young, succulent. Leaves alternate, 4–12 × 2–8 cm, ovate to rhombic-ovate, base truncate or cuneate, apex acute to acuminate, margins sinuate or dentate, pubescent on both surfaces with + glandular hairs, or sometimes glabrous; petiole somewhat winged, 2–10 cm; upper leaves smaller, lanceolate. Flowers in terminal cymes; pedicel 5–15 mm. Calyx 15–25 mm, tubular-campanulate, 5-lobed, enlarging in fruit and becoming dry, veins distinct, persistent; lobes ± equal, obtuse, pubescent and with short glandular hairs. Corolla 30–50 mm, funnel-shaped, white to pale yellow suffused with purple, with purple markings within, 5-lobed; lobes obtuse, upper lip dark purple.

Stamens exserted; anthers 3–4 mm. Style 3–4 cm, exserted; stigma capitate. Capsule 5–6 mm in diameter, subglobose, dehiscing by an apical lid.

Flowering and fruiting: February to May.

Distribution and habitat: Northern Oman, in the foothills of the mountains, in wadis, dry and gravely places, and by roadsides. *Altitude*: 300–800 m. Distributed in N Africa through Arabia to Iraq, Iran, Afghanistan to Pakistan. Elsewhere in Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 590.

2. ***Hyoscyamus gallagheri*** A.G.Mill. & Biagi, Notes R.B.G. Edinb. 45(1): 70 (1988).
Type: Oman, Sahel al Jazir, Rima to Ras Madraka road, Khor Dirrif, 1 Oct. 1984, *Miller* 6509 (holotype E; isotypes K, ON, UPS).
Vernacular names: zgaf, zaghaf.

Description: Perennial herb with a woody base, up to 30 cm high, forming clumps up to 1 m across, succulent; stems ± branched, decumbent to erect, covered with remains of old leaves below, densely tomentose with short branched hairs and glandular hairs. Leaves crowded, appearing rosetted, 3.5–8 × 0.7–1 cm, narrowly obovate, base long attenuate, apex acute, margins entire, greyish-green. Flowers in ascending racemes, terminal, sweetly aromatic; pedicels 10–15 mm. Calyx 22–30 mm, campanulate, 5–lobed, accrescent in fruit; lobes ± equal, with the uppermost largest, broadly triangular, acute; fruiting calyx enlarged, 2.5–4 cm, distinctly veined, becoming papery. Corolla pale mauve with yellow markings in throat, 30–45mm, funnel-shaped, 5-lobed, glabrous; lobes unequal, broadly ovate-triangular, the 2 lower smaller than the upper 3. Stamens exserted; anthers 1–2 mm long. Style 2.5–4 mm, exserted; stigma capitate. Capsule 6–15 × 4–8 mm, obovoid, dehiscense circumsessile. Seeds alveolate.

Flowering and fruiting: October to December.

Distribution and habitat: Central Oman, distributed along the Sahil al Jazir coast on sand dunes, on open limestone plateau and low limestone hills above the coast. *Altitude*: 0–200 m. Endemic to Central Oman.

Distribution map & Illustration: 591.

3. ***Hyoscyamus flaccidus*** Wright, Kew Bull. 184 (1895).
Type: Oman, Dhofar, Wadi Gergio, 450m, 1894, *T.J. Bent* 168 (holotype K).
Vernacular name: zgaf.

Description: Annual herb with short branches; stems decumbent to erect, villous. Leaves 5.5–11.5 × 5–13.5 cm, rounded or orbicular, apex acute, base cordate; petiole 3–10 cm long. Inflorescence terminal of few-flowered raceme; pedicels 0.8–15 mm, villous. Calyx 8–12 mm, campanulate, villous, 5-lobed; lobes acute. Corolla white with violet line in

throat, 10–15 mm, funnel-shaped. Stamens exserted; anthers 1–2 mm. Styles 0.6–1 mm, exserted; stigma capitate. Capsule 5–8 × 3–5 mm, oblong.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar on the wet escarpment mountains in *Anogeissus* woodland, in damp and shady places. *Altitude*: ± 500 m. A regional endemic, found in Dhofar and in the Al Mahra in Yemen (S).

Distribution map & Illustration: 592.

Cultivated species

Capsicum annum L. (1753).
Vernacular names: fil filakhdar, fil fil akhdar har. *Common English names*: Bell pepper, sweet pepper, hot pepper.
Annual herb. Leaves 4–8 cm long, ovate to lanceolate. Berry red sometimes orange, yellow or blackish. Fruit used as condiment and vegetable.

Lycopersicon esculentum Mill. (1768).
Synonym: *Solanum lycopersicon* L.
Vernacular name: tamatum. *Common English name*: Tomato.
Annual herb. Leaves compound, leaflets ovate-lanceolate. Berry red or yellowish. Cultivated in Oman, both commercially and in private homes and farms.

Solanum melongena L. (1753).
Vernacular name: batingan. *Common English names*: Egg plant, brinjal.
Annual herb. Leaves ovate or oblong. Fruit large, white, yellowish or blackish-purple. Cultivated commonly in farms in the foothills of the northern mountains and in farms around Salalah.

Solanum tuberosum L. (1753).
Vernacular name: batata. *Common English name*: Potato.
Biennial or perennial herb with underground tubers. Leaves compound, leaflets ovate or suborbicular. Not commonly cultivated in Oman.

Nicotiana tabacum L. (1753).
Vernacular name: tabagh. *Common English name*: Tobacco.
Annual or sometimes perennial herb. Leaves ovate to elliptic or lanceolate. Corolla yellowish, greenish, red or pink. Cultivated in private farms in southern Oman but not commonly so. Dried leaves often sold in neighbouring countries.

73. Convolvulaceae

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Key to the genera of Convolvulaceae in Oman

1. Plants functionally dioecious; flowers unisexual ..... 1. **Hildebrandtia**
   Plants monoecious; flowers bisexual 2

2. Styles 2 3
   Style 1, simple 4
3. Stamens and styles included ..... 2. **Seddera**
   Stamens and styles exserted ..... 3. **Cressa**
4. Fruit capsular dehiscing by 4 valves 5
   Fruit indehiscent or dehiscing irregularly ..... 7. **Stictocardia**
5. Stigmas filiform ..... 4. **Convolvulus**
   Stigmas globose 6
6. Corolla usually purple or yellow; pollen spinulose; anthers straight after dehiscence ..... 6. **Ipomoea**
   Corolla yellow or white with a reddish purple centre; pollen smooth; anthers spirally twisted after dehiscence ..... 5. **Merremia**

1. **Hildebrandtia** Vatke

Ten species distributed from NE tropical Africa to SW Arabia, and Madagascar.

Hildebrandtia africana Vatke, Schriften Berlin Geo. Nat. Fr. 1876: 8 (1876).
subsp. ***arabica*** Sebsebe, Kew Bull. 51(3): 529 (1996).

Type: Oman, Dhofar, Coastal cliffs of Ras Hamar, west of Salalah, 150 m, 17 Sep. 1984, *Miller* 6115 (holotype E, isotype K).

Vernacular name: etebin (Jibbali).

Description: Dioecious shrub, 0.4–1.5 m; branches dark grey-brown, glabrous to pubescent. Leaves alternate, solitary or in clusters of 2–5 on short shoots, obovate to obovate-oblong, 10–25(–38) × 3–12(–24) mm, base tapering, apex rounded, margins entire, appressed silvery pubescent to villous with medifixed hairs. Male bush floriferous. Flowers (1)2–3, axillary, on short shoots; pedicels 2–3 mm. Calyx 4, ± equal, lobes 2.5 mm, ovate, acute or obtuse. Corolla cream or pale yellow. Stamens 4. Stigma twice dived into linear lobes; sterile ovary present. Female bush with scattered flowers. Flowers 1–2, axillary on short shoots; pedicels 8–12 mm. Calyx lobes 4, very unequal, the inner 2 ± 1 mm long, ovate, outer 11–12 mm, enlarging to 15 mm in fruit, orbicular with cordate base, completely enclosing the corolla, pubescent, ciliate. Corolla cream or pale yellow. Stamens 4, sterile; Styles 2, stigma divided into uneven lobes. Capsule ± 4 mm long, globose, dehiscing by 4 valves, all enclosed by the enlarged outer calyx lobes.

Flowering and fruiting: August, September.

Distribution and habitat: Southern Oman, Dhofar, in dry woodlands, and on slopes of the escarpment mountains and coastal cliffs with *Acacia*, *Commiphora*, *Euphorbia balsamifera* and *Anogeissus dhofarica*. *Altitude*: 60–1400 m. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 593.

Notes: All our material falls under subsp. *arabica*. The differences between subsp. *africana*

& subsp. *arabica* are: pedicels up to 2 mm, leaves densely appressed pubescent to villous subsp. *africana*; pedicels 3–5 mm, leaves sparsely appressed pubescent – subsp. *arabica*. Subsp. *africana* is distributed in NE Africa.

2. **Seddera** Hochst. & Steud.

30 species distributed in Africa, the Arabian Peninsula and eastwards through Iraq, Iran, Pakistan to India.

1. Flowers in dense globose heads ..... 1. **S. glomerata**
   Flowers solitary or paired 2
2. Inflorescence pedunculate ..... 4. **S. retusa**
   Inflorescence sessile 3
3. Leaves 4–15 × 2–8 mm, elliptic to ovate to oblanceolate, obtuse, mucronulate ..... 2. **S. latifolia**
   Leaves 7–18 × 4.5–12.5 mm, elliptic–ovate to obovate to broadly ovate, apex acute, apiculate ..... 3. **S. velutina**

1. ***Seddera glomerata*** (Balf.f.) Schwartz, Mitt. Inst. Bot. Hamburg 10: 197 (1939). subsp. ***dhofarensis*** R.R.Mill, Kew Bull. 64(2): 224 (2009).

Type: Oman, Dhofar: Jebel Qara, Salalah to Thamrait road, 810 m, 22 Sept. 1985, *A.G. Miller* 7751 (holotype E; isotypes K, ON).

Description: Perennial herb or low shrub, 10–30 cm tall with prostrate to ascending branches arising from a woody base, silvery-white tomentose. Leaves opposite, 5–25 × 3.5–15 mm, ovate to oblanceolate, base cuneate, apex acute to mucronate, margins entire, silvery-grey tomentose; petiole 1–4 mm. Inflorescence terminal. Flowers sessile, in terminal 3–9-flowered sessile globose heads, 6–10 mm in diameter; bracts and bracteoles foliaceous, plumose. Sepals 5, unequal, 4–5 mm, narrowly elliptic, acuminate, sericeous. Corolla white to pink, ± 5 mm, narrow funnel-shaped, pubescent on the mid petal nerves, hairs short and appressed. Ovary villous. Capsule ± 2.5 mm, broadly ovoid, apically pubescent.

Flowering and fruiting: September, October.

Distribution and habitat: Southern Oman, Dhofar, in dry areas on the mountains at the edge of the *Euphorbia balsamifera* zone with *Acacia* and *Commiphora* and on open rocky and stony slopes with *Boswellia*. *Altitude*: 50–1600 m. Elsewhere in the Arabian Peninsula found in Yemen (Hadramaut).

Distribution map & Illustration: 594.

Notes: According to Mill, our plants fall under subsp. *dhofarensis*, which differs from subsp. *glomerata* in having acute leaves, smaller flower heads (13–18 mm in *glomerata*), and longer mid-petaline hairs that exceed the corolla.

2. ***Seddera latifolia*** Hochst. & Steud. [in sched. Schimper Unio It. 1837] (1844: 8, t. 5, f. B & C).

Synonym: *Breweria latifolia* Hochst. (1844). Type: Saudi Arabia, Hejaz, near Ferihe, *Schimper* 884 (holotype B destroyed; isotypes G–DC, K).

Description: Low shrub, up to 30 cm tall with erect to spreading branches, silvery-white tomentose. Leaves opposite, 4–15 × 2–8 mm, elliptic to ovate to oblanceolate, base cuneate to truncate, apex obtuse, mucronulate, margins entire, silvery-grey tomentose; petiole ± 1 mm. Flowers sessile, 1–2, axillary; bracts 1–2 mm, linear; peduncles and pedicels absent. Sepals 5, slightly unequal, 3.5– 4.5 mm, ovate to elliptic, acute to acuminate, silvery pubescent. Corolla white, 4–5 mm, pubescent on the mid petaline nerves. Stamens with subequal filaments. Ovary pubescent. Capsule ± 4 mm, ovoid, apically pubescent.

Flowering and fruiting: February to April; September to December.

Distribution and habitat: Northern and Southern Oman, and Musandam, in dry sandy and gravely habitats, rocky slopes, and open *Acacia* woodland. *Altitude*: 50–1000 m. Distributed in Eritrea, Ethiopia, Sudan, Somalia, Niger, Mauritania, Egypt, Pakistan and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 595.

3. ***Seddera velutina*** R.R.Mill, Kew Bull. 64(2): 206 (2009).
Type: Oman, Dhofar, Wadi Afal, 5 Sept. 1989, *Miller & Nyberg* M. 9103 (holotype E).

Description: Low shrub, 20–40 cm tall; stems with ascending branches arising from a woody base, branches somewhat zig-zagging, silvery-white hairy with long and short hairs. Leaves opposite, numerous throughout the stems, pale green, 7–18 × 4.5–12.5 mm, elliptic-ovate to obovate to broadly ovate, base cuneate, apex acute, apiculate, margins entire, silvery-grey hairy, appearing velvety; petiole 1–2 mm. Inflorescence of axillary and terminal, few-flowered clusters; flowers sessile or pedicels 0.5 mm, solitary or paired, ebracteolate. Sepals 5, outer and inner sepals ± similar, 3–5 mm, linear-lanceolate to ovate-lanceolate, acute to acuminate, sericeous. Corolla white, ± 4 mm, tubular-infundibuliform, pubescent sericeous on the mid petaline areas. Stamens inserted at the base of the corolla, exserted from the corolla tube. Styles very slightly shorter than corolla. Ovary villous. Capsule ± 3 mm, ovoid, distally sparsely sericeous.

Flowering and fruiting: September, October.

Distribution and habitat: Southern Oman, Dhofar, on gravely slopes and stony plains dominated by *Boswellia* or *Euphorbia* scrub. *Altitude*: 0–1000 m. Endemic to Oman in the Dhofar region.

Distribution map & Illustration: 596.

Notes: The species has a limited range of distribution and its conservation status has been assessed here as Near Threatened (NT) on the National Red List. The area where the spe-

cies occurs is marked for development and road building, which may cause a threat to the species.

4. ***Seddera retusa*** R.R.Mill, Kew Bull. 64(2): 205 (2009).
Type: Oman, Dhofar, Wadi Afal, 50 m, 5 Sept. 1989, *Miller & Nyberg* M. 9095 (holotype E; isotypes K, ON).

Description: Perennial herb, up to 80 cm; Stems erect to decumbent to ascending, branched, arising from a woody base, silvery–white adpressed hairy. Leaves few, mainly in the lower part of stems, grey-green, 5–25 × 3–15 mm, ovate to oblong to obovate-elliptic, base cuneate, apex rounded to usually retuse, or shortly apiculate, margins entire, pubescent; petiole ± 1 mm. Flowers axillary, in 1–3-flowered lax racemes; peduncle 3–12 mm; pedicels ± 1 mm; bracts 1–3 mm, linear, sericeous. Sepals 5, equal in length, 3–4 mm, the inner narrower than outer, ovate, convex, acute, densely white sericeous. Corolla white to greenish-white, subrotate to campanulate, ± 5 mm, pubescent on the mid petaline areas, glabrous within. Stamens inserted towards the base of the tube, exserted. Styles 2, filiform. Capsule ± 5 mm, ovoid, villous at the apex. Seeds black, strongly compressed.

Flowering and fruiting: September, October.

Distribution and habitat: Southern Oman, Dhofar, in dry wadis, on rocky slopes, on lower slopes of the escarpment mountains, and in open woodland with *Boswellia*, *Acacia* and *Aloe dhofarense*. *Altitude*: 50–200 m. Endemic to Oman, in Dhofar.

Distribution map & Illustration: 597.

Notes: The species has a limited range of distribution and its conservation status has been assessed here as Near Threatened (NT) on the National Red List. The area where the species occurs is developing and roads are likely to be built which may pose a threat to the existence of the species.

3. **Cressa** L.
A genus of four species distributed in tropical and subtropical countries of the Old and New World.

Cressa cretica L., Sp. Pl. 223 (1753).
Vernacular names: nedewah, schwayla.

Description: Perennial herb or low shrub, woody at base, 15–30 cm. Stems many, branching from the base, pilose. Leaves closely placed, sessile, 2–9 × 1–6 mm, ovate-lanceolate, base cordate to cuneate, apex acute, margins entire, appressed pubescent. Flowers small, in bracteate clusters at the tips of branches. Calyx 5-lobed, 3–4 mm, lobes ovate, acute, appressed pilose. Corolla white to whitish-pink, 5–6 mm long. Capsule 3–4 mm, ovoid, 2–4-valved, 1-seeded.

Flowering and fruiting: April to June or sporadically more or less throughout the year.

Distribution and habitat: Scattered throughout Oman, in coastal areas, in saline depressions, and sandy and saline soils near coasts. *Altitude*: 0–50 m. Distributed in northern and northeast Africa, southern Europe, and east to Pakistan, India, Sri Lanka. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 598.

4. **Convolvulus** L.

About 250 species distributed mainly in the temperate and subtropical regions of the world.

1. Spiny low shrubs with spinescent branches 2
   Low shrubs or herbs without spinescent branches 4
2. Lateral branches short, ± horizontal, ending in sharp points; ovary glabrous (flowers in compact clusters in the axils of spiny lateral branches) ..... 3. **C. hystrix**
   Lateral branches often dichotomous at end, spinescent; ovary hairy 7
3. Stems and leaves very sparsely pubescent or glabrous 4
   Stems and leaves pubescent to densely tomentose, ± glandular 7
4. Leaf margins irregularly crenate; annual with ± erect to trailing slender stems ..... 10. **C. fatmensis**
   Leaf margins entire 5
5. Stems rigid, erect; leaves with truncate to auriculate base; corolla < 2 cm long ..... 4. **C. virgatus**
   Stems weak, prostrate to twining; leaves with hastate or sagittate base; corolla ± 2 cm long ..... 9. **C. arvensis**
6. Sepals with long sericeous hairs; corolla 17–20 mm long ..... 1. **C. acanthocladus**
   Sepals with short adpressed hairs; corolla ± 8 mm long ..... 2. **C. ulicinus**
7. Leaves opposite to subopposite ..... 8. **C. oppositifolius**
   Leaves alternate 8
8. Lower leaves often long attenuate; leaf margins undulate to sinuate, veins impressed; stems stout, densely tomentellous ..... 7. **C. cephalopodus**
   Lower leaves not long attenuate; leaf margins entire; stems weak, pubescent to adpressed hairy 9
9. Leaves sessile, (5–)7–15 × 2–3 mm, oblong to linear-lanceolate to elliptic; flowers 2–3 in axillary pedunculate heads; peduncle 3–30 mm ..... 6. **C. prostratus**
   Leaves petiolate, 10–40 × 4–18 mm, ovate-lanceolate to linear-lanceolate; petiole 5–9 mm; flowers 4–6 in compact pedunculate heads; peduncle 20–60 mm ..... 5. **C. glomeratus**

1. ***Convolvulus acanthocladus*** Boiss., Diagn. ser. 1, 7, 27 (1846); Fl. Orient. 4: 86 (1879).
Vernacular name: shajarat al ghubrah.

Description: Low woody shrub, up to 50 cm. Stems and branches rigid, divaricate, branch-

ing intricately, ending in spines, densely sericeous, grey-green. Leaves sessile, grey-green, 5–15 × 2–5 mm, oblanceolate, often plicate, base attenuate, apex acute to obtuse, adpressed pubescent, deciduous. Flowers axillary or terminal, solitary or few in cymes; pedicels ± 6 mm. Sepals unequal, outer sepals 8–9 mm, basally convex, ovate-lanceolate, with a long acuminate tip, white sericeous; inner sepals 7–8 mm, lanceolate, acuminate, membranous. Corolla pink, funnel-shaped, 17–20 mm long, 1.5–2 cm in diameter, glabrous but with a sericeous med-petaline area, tube glabrous. Stamens unequal; filaments with sessile glands on the flattened part. Capsule ± 6 × 5 mm, ovoid, hairy at the apex, 4-valved.

Flowering and fruiting: March to May.

Distribution and habitat: Northern Oman, in the western and eastern Hajar mountains and Musandam (Ru'us al Jibal), on rocky slopes, and in small depressions amongst rocks and stones. *Altitude*: 500–1000 m. Distributed in SW Pakistan (Baluchistan) and Iran. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 599.

Notes: An Iranian species of arid mountains and a regional endemic, not common on the Jebel Akhdar mountains; more abundant and common on the Musandam mountains.

2. ***Convolvulus ulicinus*** Boiss., Diagn. ser. 1, 7, 26 (1846); Fl. Orient. 4: 89 (1879). Type: Oman, Muscat, *Aucher-Eloy* 4936 (holotype P; isotypes G, K, LE, W).

Description: Intricately branched low woody shrub, up to 30 cm; stems and branches divaricate, often ending in dichotomies, spinescent; young branches densely adpressed pubescent, the older glabrescent, grey-green. Leaves sessile, grey-green, 10–15 × 3–4 mm, oblanceolate, base attenuate, apex acute to obtuse, adpressed pubescent, deciduous. Flowers sessile, 1–2 in axillary heads (up to 4 in Iran plants); bracts and bracteoles broadly ovate to suborbicular. Sepals unequal, short adpressed pubescent, outer sepals ± 7mm, basally convex, oblong to obovate, with a long acuminate tip; inner sepals ± 6 mm, lanceolate with narrow membranous margins. Corolla white, funnel-shaped, ± 8 mm, glabrous but with a sericeous med-petaline area, tube glabrous. Stamens unequal; filaments with sessile glands on the flattened part. Capsule ± 3 mm, ovoid, hairy at the apex, 4-valved.

Flowering and fruiting: October to November.

Distribution and habitat: Northern Oman, in the western and eastern Hajar mountains, and Musandam, on rocky slopes, with *Prunus arabicus*, *Ephedra pachyclada* and *Dodonaea viscosa*. *Altitude*: 350–1950 m. Distributed in SW Pakistan (Baluchistan) and Iran. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 600.

Notes: *C. ulicinus* is very similar to *C. acanthocladus* in habit but differs in its pubescence which is short adpressed in the former but sericeous in the latter, and in its smaller flowers. There is very little material that I have seen from Oman, Iran and Baluchistan, much of which is vegetative. It is possible that this is a high altitude ecotype of *C. acanthocladus*

3. ***Convolvulus hystrix*** Vahl, Symb. Bot. 1: 16 (1790).

Description: Intricately branched spiny low woody shrub, 30–50 cm; lateral branches prostrate to ± erect, short, ± horizontal, ending in sharp points, densely white adpressed pubescent, older stems glabrescent, grey-green. Leaves sessile, grey-green, 4–10 × 2–3 mm, oblong to oblanceolate, base truncate to auriculate, apex acute, adpressed pubescent, deciduous. Flowers sessile, 1–6 in compact clusters, in the axils of spiny lateral branches; bracts and bracteoles triangular to obovate. Sepals unequal, outer two sepals 8–9 mm, basally convex, broadly ovate, densely whitish sericeous; inner 3 sepals 7–8 mm, oblong, long acuminate, pubescent and membranous. Corolla pink to violet, funnel-shaped, ± 12 mm long, glabrous but with a sericeous med-petaline area, tube glabrous. Stamens unequal; filaments with sessile glands on the flattened part. Capsule ± 3 mm, obovoid, glabrous, 4-valved.

Flowering and fruiting: September to November.

Distribution and habitat: Northern, southern and central Oman, in sandy and sandy rocky areas, dry rocky slopes, and shallow sandy depressions, with *Acacia tortilis*, in Dhofar with *Boswellia sacra*. *Altitude*: 100–1500 m. Distributed in Egypt, Sudan, Eritrea. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 601.

Notes: This species is variable in its indumentum which, in Oman, appears to be related to where the plant is growing; when ungrazed the main stems can grow up to 50 cm long, but the plant is often badly grazed. Plants with dense indumentum have been separated as subsp. *dhofarica* R.R.Mill. (in sched.), but apart from the dense indumentums, there are no differences that would separate this taxon justifiably.

4. ***Convolvulus virgatus*** Boiss., Diagn. ser. 1, 7, 25 (1846); Fl. Orient. 4: 88 (1879).
Synonyms: *Convolvulus mascatensis* Boiss. (1846). Type: Oman, Muscat, *Aucher-Eloy* 4938 (holotype P; isotypes G, K). *C. virgatus* var. *subaphyllus* Boiss. (1875). Type as for *C. mascatensis*.

Description: Straggly low woody shrub with rigid or herbaceous branches, 30–50 cm, grey-green, glabrous. Leaves sessile to shortly petiolate, grey-green, 10–20 × 2–3 mm, linear–lanceolate, base truncate to auriculate, apex acute, margins often inrolled, glabrous, deciduous. Flowers in pedunculate axillary clusters; peduncle 15–35 mm; bracts and bracteoles ± 10 mm, lanceolate, with long brownish hairs. Sepals unequal, outer sepals 10–11 mm, linear oblong to oblanceolate, with a long acuminate tip, white sericeous; the middle sepals with unequal halves with one half membranous; inner sepal 7–8 mm, lanceolate, acuminate, membranous. Corolla white, 11–14 mm long, glabrous but with a sericeous mid-petaline area, tube glabrous. Stamens unequal; filaments with sessile glands on the flattened part. Capsule ± 4 mm, ovoid, glabrous.

Flowering and fruiting: March to April.

Distribution and habitat: Northern Oman, in the foothills of the mountains, wadi beds, amongst stones; rare at higher altitudes. *Altitude*: 50–800(–1200) m. Distributed in Iran. Elsewhere in the Arabian Peninsula found in UAE.

Distribution map & Illustration: 602.

Notes: A regional endemic found in southern Iran, northern Oman and UAE. In Iran it is found on higher altitudes than in Oman.

5. ***Convolvulus glomeratus*** Choisy in DC., Prodr. 9: 401 (1845).
Synonym: *Convolvulus arabicus* Hochst. ex Hallier f. (1894).

Description: Woody based perennial herb with ± erect to prostrate to twining, simple or branched stems, up to 1 m long, ± pubescent to adpressed puberulous. Leaves 10–40 × 4–18 mm, ovate-lanceolate to linear-lanceolate, base truncate to auriculate, apex acute to obtuse, margins entire, adpressed pubescent; petiole 5–9 mm. Flowers sessile, 4–6 in compact pedunculate heads; peduncle 20–60 mm; bracts and bracteoles as leaves, lanceolate, acute. Sepals unequal; outer sepals 7–10 mm, elliptic, acuminate with long sericeous and spreading whitish brown hairs (brownish in dried specimens). Central petal with both halves unequal and one half membranous; inner sepal lanceolate, acuminate, membranous. Corolla white to pale pink-purple, glabrous but with a sericeous mid-petaline area, tube glabrous. Stamens unequal; filaments with sessile glands on the flattened part. Capsule ± 5 mm, ovoid, glabrous, 4-valved.

Flowering and fruiting: March; September to October.

Distribution and habitat: Northern and Southern Oman, Dhofar, in the foothills and slopes of wooded escarpment, in sandy and sandy depressions in gravely locations, and edges of cultivated fields. *Altitude*: 100–1000 m. Distributed in Egypt, Sudan, Somalia, Djibouti, Ethiopia, Palestine, Iran, Afghanistan, Pakistan and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen, UAE; also found on Soqotra.

Distribution map & Illustration: 603.

Notes: A common species of the foothills. Plants with sparsely pubescent shoots and peduncle as long as or longer than the subtending bract have been placed in var. *glomeratus* (Sa'ad, l.c., p. 83) and densely puberulous plants with peduncles shorter than the subtending bract placed under var. *gymnospermus* Sa'ad. All our material is referable to var. *glomeratus* as far as peduncle length is concerned, but vary in pubescence from being sparsely to densely pubescent.

6. ***Convolvulus prostratus*** Forssk., Fl. Aegypt.-Arab.: 203 (1775).
Type: Yemen, Wadi Mawr ("Mor"), Jan. 1763, *Forsskal* 438, 446, 1138 (syntypes C).
Synonyms: *Convolvulus microphyllus* Sieb. ex Spreng. (1825); *C. deserti* Hochst. & Steud. (1837). Type: Arabia, near Jeddah (Dscheddam), *Schimper* 738 (syntypes K, L, M, MPU).

Description: Perennial herb with prostrate to ascending stems, up to 50 cm, arising from

a woody based, sparsely to densely adpressed pubescent intermixed with spreading hairs. Leaves sessile, (5–)7–15 × 2–3 mm, oblong to linear–lanceolate to elliptic, base tapering, apex acute, margins entire, adpressed long hairy. Flowers sessile, 2–3 in axillary pedunculate heads; peduncle 3–30 mm; bracts and bracteoles as leaves, but smaller. Sepals unequal; outer sepals 5–6 mm, ovate, acuminate, convex basally with long sericeous and spreading whitish-brown hairs; inner 3 sepals 4–5 mm, ovate , acuminate, margins membranous. Corolla pale blue to whitish-pink, glabrous but with a sericeous med-petaline area, tube glabrous. Stamens unequal; filaments with sessile glands on the flattened part. Capsule ± 3 mm, ovoid, glabrous, 4-valved.

Flowering and fruiting: September to November.

Distribution and habitat: Northern and southern Oman, in dry sandy and stony areas, at edges of sandy desert, and in irrigation ditches. *Altitude*: 50–700 m. Distributed in Egypt, Sudan, Iran. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 604.

Notes: A variable species where some plants (Rustaq, *Mandaville* 6218, Khasab, *Mandaville* 7329) show very slender stems, small leaves (0.5–1.5 mm), and single, very shortly pedicellate flowers. These characters are distinct from the typical *prostratus* where leaves are generally larger and the inflorescence is of 2–3, sessile flowers.

7. ***Convolvulus cephalopodus*** Boiss., Diagn. Pl. Or. 1, 7, 24 (1846).
Synonym: *Convolvulus buschiricus* Bornm. (1945).

Description: Woody based perennial herb or low shrub with ± erect to decumbent stout stems up to 40 cm, densely tomentellous. Leaves sessile, densely tomentose, lower leaves 15–22 × 4–6 mm, oblanceolate, apex ± mucronate to acute, base attenuate; the upper leaves 6–13 × 4–6 mm, elliptic to ovate to lanceolate, base truncate, apex acute, all leaves with margins sinuate, veins impressed. Flowers sessile, 2–4 in compact pedunculate heads; peduncle 5–20 mm, tomentose with spreading hairs; bracts and bracteoles ovate. Sepals unequal; outer sepals ± 8 mm, ovate-lanceolate, tomentose; inner sepal ± 7 mm, linear-lanceolate, acuminate. Corolla pink to white, ± 15 mm, glabrous but with a sericeous med-petaline area, tube glabrous. Stamens unequal; filaments with sessile glands on the flattened part. Capsule ± 4 mm, subglobose, hairy at apex, 4-valved.

Flowering and fruiting: February.

Distribution and habitat: Northern Oman, in the foothills and the Batinah coast, in sand and on coastal dunes. *Altitude*: 20–30 m. Distributed in Iraq, Iran and SW Pakistan. Elsewhere in the Arabian Peninsula found in Qatar, Kuwait, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 605.

8. ***Convolvulus oppositifolia*** Al Farhan, Bot. J. Linn. Soc. 106: 259 (1991).
Type: Oman, Sahil Al Jazir, Wadi Qadam, 50 m, 13 May 1983, *Gallagher* 6763/2 (holotype E).

Description: Woody based perennial herb or low shrub up to 30 cm, stems branched, tomentellous. Leaves opposite to subopposite, 9–14 × 3–5 mm, obovate to ovate to ovate-oblong, base attenuating in a short petiole, apex obtuse, margins entire, tomentose, glandular. Flowers axillary, sessile, solitary; bracts as leaves. Sepals unequal, tomentose; outer sepals 7–8 mm, lanceolate; inner sepals 6–7 mm, lanceolate, acute. Corolla blue to pale purple, 11–13 mm, ± 1.5 cm across, glabrous but with a sericeous med-petaline area, tube glabrous. Stamens unequal; filaments with sessile glands on the flattened part. Capsule ± 4 mm, subglobose, glabrous, 4-valved.

Flowering and fruiting: December to February.

Distribution and habitat: Central Oman, on the Sahil al Jazir coast, and wadis leading from Jiddat Arkad, in sandy depressions with *Acacia tortilis* and *Ziziphus leucodermis*. *Altitude*: 10–80 m. Endemic to eastern Oman.

Flowering and fruiting: May; September to October.

Distribution map & Illustration: 606.

9. ***Convolvulus arvensis*** L., Sp. Pl. 153 (1753).
Synonym: *Convolvulus hastatus* Forssk. (1775). Type: Egypt, *Forsskal* 1131, 1132, 1133 (syntypes C).
Vernacular names: fadakh, mulawwiya, al-layq, al-layg, al-olleygah.

Description: Perennial herb. Stems prostrate to twining, glabrous or pubescent. Leaves 1.5–7 × 1–3 cm, ovate-oblong to lanceolate, base hastate or sagittate, apex obtuse, margins entire, glabrescent; petiole 0.5–2 cm. Flowers axillary, solitary or in 2–3-flowered cymes; peduncle 2–4 cm; pedicels 7–15 mm; bracts 2–3 mm, linear. Sepals ± unequal, 3–5 × 2–3 mm, oblong to broadly ovate. Corolla white and or pink, broadly funnel-shaped, 2–2.5 cm long, shallowly lobed, glabrous except at the apices of the med-petaline areas. Stamens unequal, included. Capsule 5–8 mm, ovoid-globose, glabrous, 4-seeded.

Flowering and fruiting: September to November.

Distribution and habitat: Throughout Oman, in irrigated fields and plantations, ditches and tree pits along roads; weedy. *Altitude*: Widespread in subtropical and temperate parts of the world. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 607.

10. ***Convolvulus fatmensis*** Kunze, Fl. Allg. Bot. Zeit. 23(1): 172 (1840).
Type: Saudi Arabia, Hejaz, Wadi Fatima, *Schimper* 839 (lectotype LZ; isolectotypes GOET, HGB, JE, K, L, P, W).

Description: Annual herb with ± erect to trailing slender stems 15–50 cm, pubescent to glabrous. Leaves 15–40 × 10–20 cm, ovate to ovate-oblong, base hastate or cordate, apex obtuse, margins irregularly crenate, sparsely adpressed pubescent; petiole 20–30 mm. Flowers axillary, solitary or in 2–3-flowered cymes; peduncle up to 3 cm; pedicels ± 5 mm; bracts 2–3 mm, linear, pubescent. Sepals ± unequal, the outer ± 4 mm, obovate, sparsely pubescent with narrow membranous margins. Central petal with two halves unequal, one half with broad membranous margins; inner sepals broadly obovate, with 2 small auricles at base, membranous, glabrous. Corolla pale pink, broadly funnel-shaped, 8–10 mm, glabrous except at the apices of the med-petaline areas. Stamens unequal, included. Capsule 5–6 mm, subglobose, glabrous, 4-seeded.

Flowering and fruiting: April.

Distribution and habitat: Southern Oman, Dhofar, in grassland, under *Acacia tortilis*. *Altitude*: ± 150 m.

Distributed in Egypt, Lebanon, Palestine, Israel, ?Jordan, Iran. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 608.

Notes: Not common in the plains of Dhofar and known only from a single record collected from Salalah amongst grasses and sedges in 1976 (*Radcliffe-Smith* 4133, K) (precise locality not recorded). Its probably disappeared from there with the rapid development in the entire Salalah area.

5. **Merremia** Dennst. ex Endl.

About 70 species distributed in tropical and South Africa, Arabia and the Middle East, India, W Indian Ocean Islands, S China and Taiwan.

Calyx pilose ..... 1. **M. somalensis**
Calyx glabrous ..... 2. **M. dissecta**

1. ***Merremia somalensis*** (Vatke) Hallierf., Ann. Ist. Bot. Roma 7: 226 (1893).

Basionym: *Convolvulus somalensis* Vatke (1882). *Synonym*: *C. hadramauticus* Baker (1894). Type: Yemen, between Tokhum and Ghafit, *?J.T. Bent* (holotype K, not located).

Description: Perennial low shrub; stems ± erect to prostrate, up to 1 m or more long, glabrous to minutely papillose. Leaves alternate, 10–40 × 2–12 mm, oblong to linear-oblong to narrowly lanceolate, base cuneate, apex obtuse to acute, margins denticulate to serrulate, glabrous; petiole up to 5 mm. Flowers axillary, solitary or several in cymes; pedicels up to 5 mm; bracts ± 1 mm. Sepals 5, 10–12 mm, ovate, acute, the outer densely pilose. Corolla brownish-yellow to dull yellow with a dark red centre, 2.5–3 cm long, funnel-shaped. Capsule ± 5 mm in diameter, globose, enclosed in the pilose calyx.

Flowering and fruiting: September to November.

Distribution and habitat: Southern Oman, Dhofar, in the escarpment mountains, coastal cliffs and gravely wadi beds and banks with *Commiphora*, *Acacia*, *Jatropha*, *Boswellia*. *Altitude*: 50–500 m. Distributed in Somalia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 609.

2. ***Merremia dissecta*** (Jacq.) Hallierf., Bot. Jahrb. Syst. 16: 552 (1893).
Basionym: *Convolvulus dissectus* Jacq. (1767).

Description: Perennial herb, with twining stems, woody at base, hirsute to glabrescent. Leaves 4.5–6 × 5–8 cm, palmately lobed; lobes elliptic-lanceolate, margin coarsely dentate to irregular pinnately lobed, glabrous or puberulent, middle one larger; petiole 5 cm long with yellowish spreading hairs. Flowers axillary, 1-several; penduncle to 8 cm long, glabrous; pedicels glabrous, thicker above, tuberculate. Sepals, subequal, 13–18 mm, ovate-lanceolate, mucronulate, enlarged in fruit, glabrous. Corolla funnel-form, ± 3 cm long, white with purple throat and midpetaline bands. Capsule depressed globose, glabrous.

Flowering and fruiting: February/March.

Distribution and habitat: Northern Oman, in wadis, near habitation. *Altitude*: 800–1000 m. A native of the Americas cultivated and naturalized in Africa, Asia, Malaysia and Australia.

6. **Ipomoea** L.
Some 500 species, widespread in most tropical to warm temperate regions.

1. Leaves palmately divided to the base into 3–7 lobes ..... 7. **I. cairica**
   Leaves entire or lobed but never palmately lobed to base 2
2. Leaves deeply or shallowly emarginate at apex ..... 6. **I. pes-caprae**
   Leaves entire or 3–5-lobed 3
3. Leaves with greyish-white matted woolly hairs beneath ..... 8. **I. aitonii**
   Leaves not matted woolly beneath 4
4. Flowers in ± sessile clusters ..... 1. **I. eriocarpa**
   Flowers solitary or in few-flowered pedunculate inflorescence 5
5. Sepals with a fleshy caudate awn, glabrous ..... 9. **I. turbinata**
   Sepals acute to acuminate but without a fleshy caudate awn 6
6. Corolla pale yellow, yellow or orange usually with a dark purple centre 4. **I. obscura**
   Corolla pink or blue 7
7. Sepals long acuminate, > 2 cm ..... 3. **I. nil**
   Sepals acute, ± 2 cm 8
8. Corolla 4–5 cm long; leaves hastate to linear-oblong ..... 5. **I. aquatica**
   Corolla 1.5–2 cm; leaves narrowly to broadly ovate ..... 2. **I. sinensis**

1. ***Ipomoea eriocarpa*** R.Br., Prodr. 484 (1810).
Synonym: *Ipomoea hispida* (Vahl) Roem. & Schultes (1819).

Description: Annual or perennial herb with slender climbing or twining stems up to 1 m or more long, pubescent to pilose. Leaves alternate, 2.5–5× 4–5 cm, lanceolate to oblong or linear lanceolate, base cordate, apex acute to acuminate, margins entire, pubescent; petiole 3.5–5 cm. Flowers axillary, in sessile or shortly pedunculate cymes; peduncle 2–3 mm; pedicels 1–2 mm. Sepals ± unequal, 6–8 mm, narrowly ovate with a broad base and along acute tip, pilose. Corolla pale purple to lilac, up to 10 mm, funnel–shaped. Capsule 5–6 mm in diameter, subglobose, pilose. Seeds glabrous.

Flowering and fruiting: February to March.

Distribution and habitat: Northern Oman, on the Batinah, at edges of cultivations and irrigated areas. *Altitude*: 50–100 m. Naturalised throughout tropical Africa and Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 610.

2. ***Ipomoea sinensis*** (Desr.) Choisy, Mem. Soc. Phys. Gen. 6: 459 (1834).
Synonym: *Convolvulus sinensis* Desr. (1791).

subsp. ***blepharosepala*** (Hochst. ex A. Rich.) Meeuse, Bothalia 6: 729 (1958).
Synonym: *Ipomoea blepharosepala* Hochst ex A.Rich. (1850).

Description: Annual herb with prostrate, climbing or twining stems up to 1 m or more long, pilose. Leaves alternate, 2–18 × 1.5–7 cm, narrowly to broadly ovate, base cordate, apex acute to obtuse, margins entire, pubescent to glabrous; petiole up to 5 cm long. Flowers axillary, in 1–3-flowered cymes; peduncle up to 4 cm; pedicels up to 2 cm. Sepals ± unequal, the outer ovate-acuminate with a cordate base; inner sepals shorter and narrower, ± pilose. Corolla mauve to pink to white or pink with a purple centre, 1.5–2 cm long, funnel-shaped. Capsule 5–10 mm in diameter, globose, glabrous. Seeds densely pubescent.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains in moist shady locations with *Anogeissus*, *Delonix*, *Jatropha* and on sandy coastal areas amongst grasses. *Altitude*: 20–200 m. Distributed in Somalia, Ethiopia, Kenya, India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 611.

Notes: All our plants fall under subsp. *blepharosepala*. Subsp. *sinensis* with larger sepals is found in eastern Africa, Yemen and through tropical Asia eastwards to Taiwan.

3. ***Ipomoea nil*** (L.) Roth., Cat. Bot. 1: 36 (1797).
Basionym: *Convolvulus nil* L. (1762).
Vernacular name: kemerot (Jibbali).

Description: Annual herb with climbing, twining or prostrate stout stems up to 3 m or more long, covered with long bristly hairs or glabrous. Leaves alternate, yellowish-green above, green beneath, 4–14 × 3–14 cm, broadly ovate, usually 3-lobed but not to base, rarely entire or base cordate, lobes with acute tips, thinly appressed hairy; petiole 4–7 cm. Flowers axillary, solitary or in few-flowered cymes; peduncle 4–7 cm; pedicels 8–10 mm, pilose. Sepals ± unequal, pale green at base, 2–2.5 cm, narrowly ovate with along acuminate tip, densely hairy with spreading bristly hairs at base. Corolla blue to purple with a white tube fading pinkish, 3–6 cm long, funnel-shaped. Capsule 8–10 mm in diameter, globose to subglobose, glabrous. Seeds glabrous.

Flowering and fruiting: September to November.

Distribution and habitat: Southern Oman, Dhofar, common on the wet escarpment mountains, coastal wadis, in moist and shady areas, with *Blepharispermum hirtum*, *Jatropha* and other shrubs. Native of tropical America, now naturalised throughout the Old World tropics. *Altitude*: 20–550 m. Elsewhere in the Arabian Peninsula Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 612.

Notes: Powdered seeds made into a paste have been used traditionally for general washing, and especially getting rid of head lice. Powdered seeds mixed with oil have also been used in traditional medicine as a liniment for chest pains and to relieve difficult breathing. The fresh leaves and stems are browsed by all livestock.

4. ***Ipomoea obscura*** (L.) Ker Gawl., Bot. Reg. 3: t. 239 (1817).
Synonym: *Convolvulus obscurus* L. (1762).
Vernacular names: senin, seman (Jibbali).

Description: Annual or perennial herb with climbing or twining stems up to 1 m or more long, pubescent to almost glabrous. Leaves alternate, 5–10 × 5–6 cm, broadly ovate, base cordate, apex acute to acuminate, margins entire, thinly pubescent to glabrous; petiole 4–7 cm. Flowers axillary, solitary or in few-flowered cymes; peduncle up to 6 cm; pedicels up to 3 cm. Sepals ± unequal, 5–7 mm, narrowly to broadly ovate with a long acute tip, glabrous to pilose. Corolla pale yellow or yellow to orange with a dark purple centre, 1.5–2.5 cm long, funnel-shaped. Capsule 8–12 mm in diameter, globose, glabrous. Seeds glabrous.

Flowering and fruiting: September to October.

Distribution and habitat: Northern and Southern Oman. Common in Dhofar on the wet escarpment mountains in woodland dominated by *Anogeissus*, edges of roads climbing over trees and shrubs; in northern Oman recorded from edges of date plantations growing by water. *Altitude*: 90–750 m. Tropical and south Africa, Madagascar, Arabia through to tropical Asia to China and Australia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 613.

Notes: Only a single record from Rustaq in the western Hajar mountains from a date plantation.

5. ***Ipomoea aquatica*** Forssk., Fl. Aegypt.-Arab.: 44 (1775).
Type: Yemen, Zabid (Zebid), *Forsskål* 447 (holotype C, isotype BM).

Description: Annual or perennial herb of marshy or aquatic places; stems prostrate, trailing or floating up to 1 m or more long, rooting at nodes, glabrous. Leaves alternate, 3–15 × 0.5–9 cm, hastate to linear–oblong, base sagittate or cordate, apex acuminate to obtuse, apiculate, margins entire, glabrous; petiole 2–25 cm. Flowers solitary or in 1–few-flowered cymes; peduncle up to 10 cm; pedicels 1.3–6 cm. Sepals ± unequal, 5–12 mm, ovate to ovate-elliptic, glabrous. Corolla blue to mauve or white with a purplish centre, 4–5 cm long, funnel-shaped. Capsule 8–10 mm in diameter, globose, glabrous, indehiscent. Seeds soft pilose or glabrous.

Flowering and fruiting: April, May.

Distribution and habitat: Southern Oman, Dhofar, at the edges of permanent shallow water pools on the escarpment hills. Cultivated in northern Oman. *Altitude*: ± 200 m. Pantropical. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 614.

Notes: The species has only been recorded from one of the pools in Wadi Darbat on Jebel Qara. In Oman the plants are white-flowered. The name *I. aquatica* was displaced in favour of *I. reptans* (Schwartz 1939: 200), but Linneaus's type of that species is a *Merremia* (Hepper & Friis, The Plants of Pehr Forsskål's Flora Aegyptiaco-Arabica, 1994: 137).

6. ***Ipomoea pes-caprae*** (L.) R.Br., Narr. Exped. R. Zaire 477 (1818).
Basionym: *Convolvulus pes-caprae* L. (1753). *Synonym*: *Ipomoea biloba* Forssk. (1775).
Type: Yemen, Zabid (Zebid), *Forsskal* 451, 4–5 April, 1763 (C) & *Forsskal* s.n. (BM) (see also note in Hepper & Friis, The Plants of Pehr Forsskål's Flora Aegyptiaco-Arabica, 1994: 138).
Vernacular names: dereg, deri, zere (Jibbali).

Description: Perennial herb with trailing, long prostrate stems, often several metres long and covering large areas on the coast, rooting at nodes, glabrous. Leaves alternate, thick, often secund, vivid green, often with pinkish margins, 3–10 × 2.5–10 cm, orbicular to reniform, base cuneate to truncate, deeply to shallowly emarginate at the apex, margins entire, glabrous; petiole 2–15 mm, with 2 glands at apex. Flowers in 1–6(–10)-flowered axillary cymes, erect; pedicels 10–20 mm, glabrous. Sepals 5, unequal, 8–11 × 5–7 mm, ovate, obtuse, the inner 3 larger. Corolla pink-purple with a dark centre, campanulate, 4–5 cm long, 5–6 cm across. Stamens 5, filaments unequal in length, included. Capsule 12–18 mm in diameter, subglobose, brown. Seeds covered with soft brown hairs.

Flowering and fruiting: More or less throughout the year.

Distribution and habitat: Southern Oman, Dhofar, and the Halaniyat Islands, on sandy coastal areas. Common and frequently cultivated. *Altitude*: 0–20 m. Pantropical. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen. Recorded on Soqotra in 1957 but not seen or collected recently (Miller & Morris, Ethnoflora of the Soqotra Archipelago, 2004: 521).

Distribution map & Illustration: 615.

7. ***Ipomoea cairica*** (L.) Sweet, Hort. Brit.: 287 (1827).
Basionym: *Convolvulus cairicus* L. (1759). *Synonym*: *Ipomoea palmata* Forssk. (1775). Type: Egypt, *Forsskål* 432, 448 (syntypes C).
Vernacular names: asiyot, asi (Jibbali).

Description: Perennial herb with prostrate, climbing or twining stems up to 1 m or more long, glabrous or villous at nodes. Leaves palmately lobed to base into 3–5(–7, rare in Oman), lobes up to 4.5 ×1.7 cm; petiole 4–6 cm. Flowers axillary, in 1- many-flowered cymes; peduncle up to 8 cm; pedicels 1–3 cm. Sepals ± unequal, 4–6 mm, broadly ovate, obtuse to acute, ± mucronulate, glabrous. Corolla purple to red-purple, 3.5–5 cm, funnel-shaped. Capsule 10–12 mm in diameter, subglobose, glabrous. Seeds with short and long hairs.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the wet escarpment mountains, in moist and shady locations and at edges of permanent pools with *Anogeissus*, *Ficus*, *Jatropha*. *Altitude*: 200–800 m. Distributed throughout tropical Africa and Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 616.

8. ***Ipomoea aitonii*** Lindley, Bot. Reg. 21: t. 1794 (1836).
Synonyms: *Ipomoea dichroa* Choisy (1845); *I. arachnosperma* Welw. (1859).

Description: Annual herb with climbing or twining stems up to 1 m or more long, pilose with spreading hairs. Leaves alternate, grey beneath, 3-lobed but not to base, lobes ± 8.5 × 10 cm, ovate, apex acute to obtuse, sparsely pilose on the upper surface, densely white matted hairs beneath. Flowers axillary, solitary or in few-flowered cymes; peduncle up to 5 cm; pedicels 10–15 mm; bracts ± 7 mm, lanceolate. Sepals ± unequal, 9–11 mm, narrowly ovate with a long acute tip, pilose. Corolla purple ± 10 mm long, funnel-shaped. Capsule globose, pubescent.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar on the wet escarpment mountains in woodland dominated by *Anogeissus*. Coastal cliffs with *Blepharispermum* and *Jatropha*. *Altitude*: 50–350 m. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 617.

Notes: Not common in Oman but possibly under-collected. Wood (Fl. Yemen, 1997: 235 (as *dichroa*)) records that leaves are usually entire in Yemen.

9. ***Ipomoea turbinata*** Lag., Gen. Sp. Pl.: 10 (1816).

Description: Annual herb with climbing or twining stems up to 1 m or more long, glabrous. Leaves alternate, pale green, 7–11 × 8–10 cm (measured on only a single specimen), ovate, base cordate, apex abruptly acuminate with a ± mucronulate tip; petiole up to 6 cm. Flowers axillary, solitary; peduncle ± thickened, 3–4 cm. Sepals ± unequal, ± 11 mm, narrowly ovate with a fleshy caudate awn, glabrous. Corolla mauve to purple, 5–7 cm, funnel-shaped. Capsule not seen.

Flowering and fruiting: September to November.

Distribution and habitat: Southern Oman, Dhofar, in the wet escarpment mountains in *Anogeissus* woodland, with *Blepharispermum hirtum*, *Croton confertus* etc. *Altitude*: ± 100 m. An Indian species, not known elsewhere in Arabia.

Distribution map & Illustration: 618.

Notes: The species is known only from a single or two specimens; it is probably an escape from cultivation.

Cultivated species

Ipomoea tricolor Cav. (1794).
Glabrous perennial herb with twining stems. Flowers in axillary cymes, blue to violet with a yellowish throat and white tube, 4–6 cm long. A native of central America, cultivated in private homes.

7. **Stictocardia** Hallier f.
Twelve species, distributed in the tropics and subtropics of the Old World, including oceanic islands.

Stictocardia macalusoi (Mattei) Verdc., Kew Bull. 15: 6 (1961).
Basionym: *Ipomoea macalusoi* Mattei (1908). *Synonyms*: *Stictocardia tiliifolia* (Desr.) Hallier f. (1893) subsp. *macalusoi* (Mattei) Verdc. (1958); *Ipomoea punctata* Baker (1895). Type: Oman, Dhofar mountains, Derbat (Darbat), *J.T. Bent* 229 (holotype K).

Description: Perennial shrub or with ± woody twinning stems, up to 1.5 m. Stems pubescent or glabrescent, ridged. Leaves dark-green, 6–15 × 6–15 cm, broadly ovate to suborbicular, base cordate, apex rounded or shortly acuminate, glabrous or slightly pubescent, covered with black glands on the under surface; petiole 2–8 cm. Inflorescence axillary, 1–2-flowered; pedicels up to 3 cm. Sepals 11–12 mm, ovate, outer ± shorter than the inner, emarginate with a small mucro, glabrous. Corolla 6–7 cm, funnel-shaped, purple, mid-petaline areas pubescent at apex. Capsule globose, pale yellow, 15–18 mm in diameter. Seeds with short hairs.

Flowering and fruiting: September/October.

Distribution and habitat: Southern Oman, Dhofar; in the escarpment hills, along the edges of water pools, in *Anogeissus* woodland. *Altitude*: 200–250 m. Distributed in Kenya and Somalia. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 619.

Notes: The flowers of Somalian and Kenyan plants are consistently dark red in colour and smaller on average than the Dhofar plants, but I have no doubt that the Dhofar plants are the same species, with a larger purple colour form. In Oman the species is found only at a single location, along the sides of the pools in Wadi Darbat, where the few collections present at Kew have been made.

74. **Cuscutaceae**

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Cuscuta L.

About 100–170 species distributed throughout the temperate and tropical regions of the world, with the greatest diversity in subtropical and tropical regions; rare in cool temperate climates.

In the Cronquist system (1981) followed here, *Cuscuta* with a single genus, is treated as a separate family Cuscutaceae; in the APG III system it is placed under Convolvulaceae.

Key to the species of Cuscuta in Oman

Flowers 4-merous ..... 1. **C. pedicellata**
Flowers 5-merous ..... 2. **C. planiflora**

1. ***Cuscuta pedicellata*** Ledeb., Fl. Alt. 1: 293, t. 234 (1829).
Synonym: *Cuscuta arabica* Fresen. (1834).

Description: Parasitic herbs with very slender yellow stems, twining over host plants. Leaves absent. Flowers ± sessile, in compact cymose clusters of 4–8 flowers, ± 5 mm across. Calyx with fleshy lobes, lobes 4, 1.5–2 mm, ovate-triangular, acute, shorter than the corolla tube. Corolla white, shortly tubular, lobes 4, erect, acute, exceeding the calyx. Stamens 4, alternating with the corolla lobes, a whorl of oblong, fringed scales present opposite to and below the stamens. Capsule ± 2 mm in diameter, depressed globose, enclosed in the calyx.

Flowering and fruiting: ?January.

Distribution and habitat: Northern Oman, Muscat area, on *Tephrosia*, rare. *Altitude*: ± 50 m. Distributed in Iran, Afghanistan, Syria, Arabia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration: 620.

Notes: I have seen only a single specimen of this species from Muscat collected in Jan. 1926 by J. Fernandez (K) which is definitely *C. pedicellata*. All other material that I have seen belongs to *C. planiflora*. The species *C. pedicellata* is recorded to be rare in Saudi Arabia.

2. ***Cuscuta planiflora*** Tenore, Fl. Napolitana: 3 (1829).
Synonyms: *Cuscuta planiflora* var. *holstii* Bak. & Rendle (1906); *C. abyssinica* A.Rich. (1851); *C. planiflora* var. *abyssinica* (A.Rich.) Verdc. (1954); *C. somaliensis* Yuncker (1932).

Description: Parasitic herbs with slender yellow or orange-red stems, twining over host plants. Leaves absent. Flowers sessile, in compact cymose clusters 5–10 mm across. Calyx with fleshy lobes, lobes 5, 1.5–5 mm, acute to obtuse. Corolla shortly tubular, lobes 5, acute or obtuse, membranous or swollen at the tips. Stamens 4–5, alternating with the corolla lobes, a whorl of oblong, fringed scales present opposite to and below the stamens. Capsule depressed globose, splitting around the base.

Flowering and fruiting: January to May.

Distribution map & Illustration: 621.

Distribution and habitat: Throughout Oman, but especially common in northern Oman, on small shrubs in the foothills of the northern mountains and on the Batinah coastal plain; common on shrubs in ditches and runnels beside roads. Recorded on *Asphodelus*, *Tephrosia*, *Ochradenus* and *Fagonia*. *Altitude*: 20–350 m. Widespread in tropical and N Africa, southern Europe, southern Asia; introduced into N America. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

75. **Boraginaceae**
including **Ehretiaceae**

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Boraginaceae is often treated as two families: Boraginaceae with mainly herbs, and Ehretiaceae with mainly trees and shrubs. Under the Cronquist system the Boraginaceae are included in the Lamiales, but it is now clear that they are no more similar to the other families in this order than they are to families in several other asterid orders. In the APG III system the Boraginaceae are included in the lamiids (euastrid 1) of asterids which also includes the orders Garryales, Gentianales, Lamiales and Solanales, but whether it should be assigned to one of these orders or to in its own order (Boraginales) is still uncertain. The Boraginaceae are paraphyletic with respect to Hydrophyllaceae and the latter is included in the former in APG III system.

Several subfamilies are recognised within the Boraginaceae, of which representatives of subfamiles Boraginoideae, Cordioideae, Ehretioideae and Helitropioideae are found in Oman.

1. Style inserted at the base of the 4-lobed ovary (in fruit between the 4 nutlets) ..... Boraginoideae (*Anchusa*, *Arnebia*, *Asperugo*, *Echiochilon*, *Gastrocotyle*, *Lappula*, *Moltkiopsis*, *Ogastemma*, *Paracaryum*, *Rochelia*, *Trichodesma*)
   Style terminal, inserted at top of drupe or nutlets 2
2. Fruit an indehiscent drupe ..... Cordioideae (*Cordia*)
   Fruit dehiscent, separating into 2 or 4 parts 3
3. Trees or shrubs; style forked or 2 styles present; fruit separating into 2-seeded halves ..... Ehretioideae (*Ehretia*)
   Annual herbs or shrubs; style not forked; fruit separating into 2 or 4 parts ..... Heliotropioideae (*Heliotropium*, *Nogalia*)

Key to the genera of Boraginaceae in Oman

1. Style terminal, inserted at top of drupe or nutlets 2
   Style basic, inserted at the base of the 4-lobed ovary (in fruit between the 4 nutlets) .. 5
2. Style 4-branched; fruit an indehiscent drupe ..... 1. **Cordia**
   Styles simple, 2 or forked; fruit of a single 4-seeded stone or separating into 2 or 4 parts 3
3. Trees or shrubs; styles 2; fruit separating into 2-seeded halves ..... 2. **Ehretia**
   Annual herbs or low shrubs; style simple or forked; fruit of a single 4-seeded stone or separating into 2 or 4 parts 4
4. Fruit with a single 4-seeded stone; mesocarp thin, fleshy ..... 3. **Nogalia**
   Fruit separating into 4, 1-seeded or 2, 2-seeded nutlets at maturity, dry or slightly fleshy ..... 4. **Heliotropium**
5. Anthers with long apical appendages, appendages twisted around each other ..... 13. **Trichodesma**
   Anthers without appendages at apex 6
6. Corolla zygomorphic, with a spreading oblique limb ..... 7. **Echiochilon**
   Corolla actinomorphic 7
7. Each nutlet with an infuxed margin concealing part of the median area ..... 11. **Paracaryum**
   Nutlets without infuxed margins 8

8. Flowers yellow; hispid annuals usually of sandy or sandy gravelly desert .. 12. **Arnebia**
Flowers white, blue, or pink (to reddish pink) 9
9. Nutlets aculeate tuberculate ..... 8. **Lappula**
Nutlets smooth or verrucose 10
10. Calyx in fruit accrescent, increasing in size, becoming folded and enveloping the fruit ..... 10. **Asperugo**
Calyx in fruit not accrescent 11
11. Calyx lobes narrow, exceeding the nutlets, incurved in fruit ..... 9. **Rochelia**
Calyx lobes not exceeding nutlets and not incurved in fruit 12
12. Corolla pink to reddish-pink, tubular, gradually broadening above .... 5. **Moltkiopsis**
Corolla white or blue 13
13. Corolla white; corolla with an invagination below each lobe ..... 6. **Ogastemma**
Corolla blue; corolla tube with appendages at throat; nutlets with basal ring with denticulate margins ..... 14. **Gastrocotyle**

1. **Cordia** L.

About 250 species, pantropical in distribution, north into Western Asia, Taiwan and Nansei-Shoto, and south USA, south to South Africa, Australia, Chile and Argentina.

1. Leaves opposite to subopposite (or crowded on short lateral shoots), elliptic to obovate to oblong-elliptic ..... 4. **C. quercifolia**
Leaves alternate, ovate to obovate to almost rounded 2
2. Leaves densely white-pubescent beneath when young, venation reticulate, conspicuous; calyx often slightly sulcate ..... 1. **C. monoica**
Leaves sparsely pubescent or glabrous, venation not conspicuous; calyx without sulcae 3
3. Leaves elliptic to obovate to obovate-oblong, base obliquely cuneate; margins crenate to dentate in the upper half, scabrid, sparsely white-pubescent beneath; venation conspicuous ..... 2. **C. obovata**
Leaves broadly elliptical to obovate to almost rounded, base rounded to cuneate; margins entire to crenate to dentate, puberulous to glabrous to ± scabrid; venation not conspicuous ..... 3. **C. crenata** subsp. **crenata**

1. ***Cordia monoica*** Roxb., Pl. Coromandel: 43, t. 58 (1796).
Synonyms: *Cordia ovalis* DC. (1845); *C. obovata* Baker (1894).
Vernacular name: sebkheedh.

Description: Shrub or small tree, up to 8 m. Bark pale grey to white, peeling; young shoots striate, with brownish hairs, older glabrous. Leaves alternate, or crowded in short shoots, 2–8.5 × 1–9 cm, broadly ovate to obovate to almost rounded, base rounded to cuneate, apex emarginate to rounded, margins entire to crenate to dentate, scabrid with bulbous-based hairs, often densely white-pubescent beneath when young, venation reticulate, conspicu-

ous, lateral veins reaching the margins; petiole 5–50 mm. Flowers fragrant, unisexual or bisexual, in few-flowered, terminal or axillary inflorescences; pedicels ± 1 mm, articulate at the apex. Calyx in both types of flowers 6–8 mm, cylindrical to funnel-shaped, often slightly sulcate, tomentose with simple and branched hairs, 3–5-lobed or 2-lipped; fruiting calyx shallow, forming a cup up to 1 cm wide. Corolla greenish-white to pale yellow, tube 4–7 mm, 3–5-lobed, lobes oblong to obovate, spreading. Male flowers: 2 forms: corolla lobes and stamens 5(–6); stamens 6 mm or 2–3 mm; style 4-branched. Female and bisexual flowers: corolla lobes 4–5; filaments 2–3 mm; ovary glabrous; style exserted. Fruit yellow or orange, fleshy, 9–20 mm, ovoid to obovoid, apiculate.

Flowering and fruiting: June to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in *Anogeissus* woodland, in *Euphorbia balsamifera* zone and in relatively drier habitats in the *Acacia-Commiphora* shrub land. *Altitude*: 800–1500 m. Widespread in tropical Africa, Sudan, Eritrea, Djibouti, Ethiopia, Somalia, and tropical Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 622.

2. ***Cordia obovata*** Balf.f., Proc. Roy. Soc. Edinb. 12: 80 (1884).
Type: Socotra, *Balfour* 277 (lectotype K; isolectotype BM).

Description: Shrub or small tree, up to 4 m. Bark grey; young shoots with brownish hispid hairs, older glabrous. Leaves alternate, 3–7 × 1–4 cm, elliptic to obovate to obovate-oblong, base obliquely cuneate, apex rounded, margins crenate to dentate in the upper half, scabrid with bulbous-based hairs, sparsely white-pubescent beneath, venation reticulate, but lateral veins not reaching margin, conspicuous; petiole 3–15 mm. Flowers in few-flowered, terminal or axillary inflorescences; pedicels ± 1 mm. Calyx ± 5 mm, cylindrical to funnel-shaped, densely tomentose, 3–4-lobed; fruiting calyx shallow, forming a cup up to 9 mm wide. Corolla greenish-white to pale yellow, tube 5–6 mm, 4-lobed, lobes oblong, spreading. Female flowers with 4 staminodes. Fruit orange, fleshy, ± 11 mm, obovoid.

Flowering and fruiting: ?July to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in *Anogeissus* woodland and in the drier areas of Jebel Qara, on dry limestone slopes at the junction of *Euphorbia balsamifera* and *Boswellia* zones. *Altitude*: 800–1300 m. Distributed in Somalia. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration: 623.

3. ***Cordia crenata*** Delile, Fl. Egypt. 195 (1): 20 (1826).
subsp. ***crenata***

Description: Small tree or shrub, 1.5–6 m. Bark pale greyish brown; young shoots ± glabrous or adpressed velvety hairy, later glabrescent. Leaves alternate, or crowded in short

shoots, 1–11 × 0.8–8 cm, broadly elliptical to obovate to almost rounded, base rounded to cuneate, apex emarginate, margins entire to crenate to dentate, puberulous to glabrous to ± scabrid; petiole 5–10 mm. Flowers male and bisexual, in corymb like inflorescence with a short peduncle; pedicels 2–3 mm. Male flowers: calyx 3–4 mm, funnel shaped, lobes triangular, glabrous. Corolla greenish-yellow, funnel-shaped, 5-lobed; tube 3.5–4 mm, lobes 4.5 mm, ovate-oblong. Ovary rudimentary, style absent. Bisexual flowers: calyx 4–5 mm, funnel-shaped, lobes triangular, glabrous outside, minutely pubescent inside; fruiting calyx 6.5–9 mm wide. Corolla tube 4–5 mm, lobes 3–4 mm, oblong. Ovary 4-locular, with 1 seed in each but usually 1 developing; style 4-branched. Fruit red, fleshy, 7–13 mm, ovoid-globose, apiculate.

Flowering and fruiting: ?June.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in *Anogeissus* woodland. *Altitude*: 50–500 m. Distributed in Uganda, Egypt, Sudan, Eritrea, Ethiopia, Somalia, Iran and India. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 624.

Notes: The tree is cultivated in the Salalah area.

4. ***Cordia quercifolia*** Klotzsch, Naturw. Reise Mossambique [Peters] 6 (Bot., 1): 247 (1861).

Synonyms: *Cordia nevillii* Alston (1931); *C. perrottetii* sensu Wight (1848) non A.DC.; *C. rothii* sensu Balf.f. (1888) non Roem. & Schult.

Description: Shrub or small tree, up to 5 m, with single trunk or many branches from base. Bark grey, flaking; young shoots brownish tomentose, older glabrous. Leaves opposite to subopposite, or crowded on short lateral shoots, 1–7.5 × 0.9–4.5 cm, elliptic to obovate to oblong-elliptic, base rounded or cuneate, apex rounded, sometimes with a mucro, or emarginate, margins entire to sinuate, or obscurely crenate in the upper half, scabrid with bulbous-based hairs, erect or adpressed, venation finely reticulate, ± conspicuous; petiole 6–15 mm. Flowers fragrant, female or bisexual, in few-flowered, terminal or axillary inflorescences; pedicels ± 1 mm. Bisexual flowers: calyx ± 5 mm, tubular to funnel-shaped, densely tomentose, 3–4-lobed; fruiting calyx shallow, forming a cup at base of fruit, up to 9 mm wide, glabrous. Corolla greenish-white to pale yellow, tube 5–6 mm, 4-lobed, lobes 3–4 mm, oblong, spreading. Female flowers with 4 staminodes; style 4-branched, exserted. Fruit orange, fleshy, 10–11 mm, ovoid to subglobose.

Flowering and fruiting: July to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, on the plains and in dried wadis; also in the Huqf region of Jiddat al Harasis in central Oman. *Altitude*: 50–800 m. Distributed in Egypt, Sudan, Eritrea, Ethiopia, Somalia, Uganda, Kenya, Tanzania, Mozambique, Chad, Mauritania, and Pakistan, India, Sri Lanka. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 625.

Notes: Verdcourt in Fl. Tropical East Africa (1991) reduced *C. nevillii* synonymous to *C. quercifolia* (type from Mozambique, lost) extending the distribution of this taxon from south-central tropical Africa to India. Thulin in Fl. Somalia (2006) has followed Warfa (1988) and retained *C. nevillii* as a separate taxon, but admits that some populations of *C. sinensis* in southern and western tropical Africa approach *C. nevellii*. The identities and nomenclature of *C. sinensis* and *C. quercifolia* are given in detail in Warfa (op. cit.). *Cordia sinensis* (syn. *C. gharaf* Ehrenb. ex Aschers.) is not recorded from Oman, as is also noted by Warfa (op. cit). A distinguishing feature of this species (*C. sinensis*) is the presence of tufts of hairs in the axils along the midrib on the leaf undersurface. It is found in Yemen and Saudi Arabia. I have not seen any material of *C. quercifolia* or *C. sinensis* from Musandam, Rus al Jibal as recorded by Jongbloed (Wild Flow. United Arab Emirates, 2003: 205), and it is not possible to identify the species illustrated as to whether it is *Cordia sinensis* or not. It is most likely *C. crenata* subsp. *crenata* or *C. quercifolia*.

Cultivated species

Cordia myxa L. (1753). (Syn. *Cordia obliqua* Willd. 1794; *C. sebestena* sensu Forssk. 1775, non L.). *Vernacular names*: kao, bambar.

Tree 6–10 m. Leaves 3–15 × 3–15 cm, broadly ovate to almost orbicular, margins usually crenate-dentate, glabrous above, glabrous to pubescent beneath, not scabrid. Flowers in a lax panicle of cymes, white, unisexual female slightly larger than the male. Fruit yellow to light orange, 13 cm, ovoid, apiculate.

Native to tropical Asia, cultivated in private gardens and farms in Oman, especially in the Salalah area. *Flowering*: March, April. The fruit is edible and is used medicinally for abdominal conditions; the seeds are used to treat worm infections and stomach problems, and tea made from leaves is used for abdominal pains. The pulp is used as glue.

Cordia sebestena L. (1753).

Tree to 8 m. Leaves 8–16 × 4–10 cm, ovate, margins entire, minutely pubescent on the nerves beneath, coriaceous. Flowers in terminal cymes, orange-red with crenulate corolla lobes. Fruit cream, 2–3 cm, ovoid.

Native to West Indies, SW USA and Venezuela, widely cultivated in private gardens and public parks throughout Oman. The fruit is edible.

2. **Ehretia** P.Browne

About 75 species distributed in the Arabian Peninsula, tropical Africa to South Africa and Madagascar, Afghanistan east to Eastern Asia and south through tropical Asia to Australia, Texas south to Mesoamerica and the Caribbean.

Ehretia obtusifolia Hochst. ex DC., Prodr. 9: 507 (1845).

Synonyms: *Ehretia aspera* Willd. var. *obtusifolia* (Hochst. ex DC.) P.J.Parmar (1991); *E. obovata* R.Br. (1814), *nomen*; *E. dhofarica* R.R.Mill. (in sched.)

Description: Shrub or small tree, up to 5 m, with often straggling branches, often with many branches from base, deciduous. Bark grey. Young shoots pubescent-glandular. Leaves alternate, 1–5 × 0.5–2 cm, elliptic, obovate to oblong-elliptic, base cuneate, apex rounded to shortly mucronate, margins entire to undulate, coriaceous, pubescent; petiole up to 2 cm.

Flowers fragrant, in cymes, terminal or on short lateral shoots, appearing before the leaves; pedicels 1–5 mm. Calyx deeply 5-lobed; lobes imbricate, ± 2 mm, ovate to elliptic, puberulous, ciliate. Corolla pale pink or white, tube ± 4 mm, 5-lobed; limb 3–5 mm, oblong to narrow triangular, spreading. Stamens exserted. Styles 2, terminal. Fruit orange, 3–4 mm, ovoid to subglobose, separating into 2-seeded halves.

Flowering and fruiting: November to May/June.

Distribution and habitat: Northern and Southern Oman, on the western Hajar mountains (common at a few localities above ± 800 m), and Musandam mountains in northern Oman, and on the lower slopes of the escarpment mountains in Dhofar, on cliffs and in shade of cliffs, and in *Acacia-Commiphora* shrub land. *Altitude*: 150–1800 m. Distributed in Eritrea, Ethiopia, Somalia, Uganda, Kenya, Tanzania, Malawi, Angola, and Afghanistan, Pakistan, India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 626.

3. **Nogalia** Verdc.

A single species with two subspecies, one in Yemen and Oman and the other in Somalia.

Nogalia drepanophyllum (Bak.) Verdc., Kew Bull. 43(3): 432 (1988).
Synonym: *Heliotropium drepanophyllum* Bak. (1894). Type: Yemen, Hadramaut, between Tokham and Ghafit, *Lunt* 69 (holotype K).

subsp. ***drepanophyllum***

Description: Perennial herb up to 45 cm, forming clumps. Stems ascending to decumbent to ± erect, sparsely to densely pubescent to pilose. Leaves alternate, fleshy, often in clusters on axillary short shoots, 6–20 × 2–5 mm, oblanceolate, sessile or base narrowing into a short petiole to 1 mm, apex obtuse, margins entire, pubescent on both surfaces. Flowers sessile in simple or forked unilateral cymes, ebracteate. Calyx 4–5 mm, 5-lobed almost to base; lobes equal, ± 4 mm, oblong, obtuse, pubescent. Corolla white or yellow, tubular, 5-lobed; tube ± 5 mm, pubescent outside, glabrous within; lobes 1–2 mm, oblong, obtuse, spreading. Stamens 5; filaments short, attached in the upper half of corolla tube, included. Style glabrous; stigmatic head ± 1 mm, conical, shortly pubescent; basal ring present. Fruit 3–5 mm across, globose, with a single 4-seeded stone, mesocarp thin, fleshy, densely hairy.

Flowering and fruiting: September/October.

Distribution and habitat: Southern Oman, Dhofar, in dry rocky coastal areas, coastal wadis, and low dry hills with *Acacia tortilis* and *Commiphora*. *Altitude*: 0–100 m. Distributed in Somalia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 627.

4. **Heliotropium** L.

About 250 species distributed in the tropical, subtropical and temperate regions of the world.

1. Cymes bracteate 2
   Cymes ebracteate 3
2. Calyx lobes connivent in fruit; corolla lobes cucullate ..... 8. **H. rariflorum**
   Calyx lobes straight, not connivent in fruit; corolla lobes acute, not cucullate ..... 7. **H. strigosum**
3. Nutlets separating into 2, each half provided with a broad wing .. 5. **H. pterocarpum**
   Nutlets separating into 4, 1-seeded parts, rarely into 2 parts, not provided with broad wings 4
4. Small shrub with woody stems; axis of inflorescence becoming spinescent ..... 9. **H. subspinosum**
   Stems not woody; axis of inflorescence not spinescent 5
5. Stigma exserted, deeply bifid, recurved ..... 3. **H. ophioglossum**
   Stigmas included, minutely bifid, not recurved 6
6. Annuals, fruiting cymes in two series (biseriate) ..... 10. **H. europaeum**
   Perennials, or rarely annuals 7
7. Nutlets glabrous, surfaces verrucose or ± rugulose 8
   Nutlets hairy 9
8. Leaves greyish-green, adpressed hairy with few tuberculate hairs, hairs 2-branched; inflorescence of slender, forked cymes up to 20 cm ..... 1. **H. longiflorum**
   Leaves dark green to blackish-green, strigose with tuberculate hairs, hairs simple; inflorescence of simple or branched cymes up to 3 cm ..... 4. **H. bacciferum**
9. Calyx lobes unequal, one lobe larger than the others ..... 6. **H. ovalifolium**
   Calyx lobes ± equal, but not one lobe largest 10
10. Leaves greyish-green, densely tomentose; style pilose; nutlets separating into 4, retrorsely short white hairy nutlets ..... 2. **H. brevilimbe**
    Leaves dark green to blackish-green, strigose with tuberculate hairs; style glabrous; nutlets separating into 4, 1-seeded nutlets or rarely into 2 pairs of fused nutlets, ± rugulose on the back, glabrous or pilose, sometimes slightly winged at edges ..... 4. **H. bacciferum**

1. ***Heliotropium longiflorum*** (Hochst. & Steud. ex A.DC.) Jaub. & Spach, Illustr. Pl. Orient. 4: t. 360 (1852).

Description: Perennial herb, up to 40 cm. Stems ± branched, erect to ascending, slender, grey-green, covered with adpressed medifixed hairs. Leaves alternate, greyish green, 20–60 × 5–30 mm, ovate to oblong-ovate, base cuneate to rounded, apex acute, margins entire, covered with adpressed medifixed hairs, densely so on the nerves, and with few scattered bulbous-based hairs between nerves; petiole up to 10 mm long. Inflorescence of scorpioid

cymes, terminal, forked, slender, up to 20 cm long; flowers becoming lax below; bracts absent. Calyx 5-lobed, persistent; lobes free to base, 1.5–2 mm, oblong-ovate, acute. Corolla white, tubular, 5-lobed above, about twice longer than calyx; tube 2.5–3 mm, hairy on the outside; lobes ± 1 mm, acute, undulate, overlapping. Stamens attached above the middle of corolla tube. Style slender, glabrous, stigma cylindrical. Nutlets 4, ovoid, glabrous, verrucose.

Flowering and fruiting: August to October.

Distribution and habitat: Southern Oman, Dhofar, in wadis, and in moist disturbed places, often in cultivated and moist open places. *Altitude*: 500–600 m. Distributed from Egypt east to west tropical Africa, Djibouti, Eritrea, Ethiopia, Somalia, Kenya, Tanzania, Angola, South Africa, Madagascar, Arabian Peninsula to Pakistan and India; introduced elsewhere. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 628.

2. ***Heliotropium brevilimbe*** Boiss., Diagn. Pl. Nov. 11: 1849 & Fl. Orient. 4: 145 (1879). *Synonyms*: *Heliotropium calcareum* Stocks (1852); *H. makranikum* Rech.f. & Esfand. (1951); *H. multiflorum* Rech. f. & Esfand. (1951).

Description: Perennial herb with a woody base, up to 35 cm. Stems branching from base, erect to ascending, grey tomentose with short adpressed and longer spreading tuberculate hairs. Leaves alternate, greyish-green, 15–36 × 12–24 mm, ovate to ovate-oblong, base cuneate, apex obtuse, margins entire to undulate, densely tomentose especially on the nerves; nerves impressed; petiole to 25 mm long. Inflorescence terminal, often paired, up to 25 cm long, flowers in scorpioid cymes, compact above, becoming lax below; bracts absent. Calyx 5-lobed, ± persistent (calyx easily falling in many plants that I have seen); lobes free to base, 2–2.5 mm, lanceolate, densely tomentose with tuberculate hairs. Corolla white, tubular, 5-lobed; tube 2.5–3mm, hairy on the outside, glabrous inside; lobes small, 0.6–1 mm, rounded, overlapping. Stamens attached slightly above the base of corolla tube. Style pilose; stigma conical. Nutlets 4, ovoid, retrorsely short white hairy.

Flowering and fruiting: September to April.

Distribution and habitat: Northern and Central Oman, and Musandam, on rocky slopes and terraces of the western Hajar mountains, gravely and sandy wadi banks, beside roads, in and around fields and date orchards, and behind vegetated beaches; common. *Altitude*: 500–600 (–1200) m. Distributed in Iran, Pakistan. Elsewhere in the Arabian Peninsula found in the UAE (see Akhani 2007: 413, Fig. 31, cited above).

Distribution map & Illustration: 629.

Notes: Described from Iran, this is a polymorphic species which is found commonly in southern Iran, SW Pakistan, northern Oman and the UAE.

Wild collected seed from this species is present at the Millennium Seed Bank, Wakehurst Place, nos. 9-932-92.10243, serial no: 009639-9.

3. ***Heliotropium ophioglossum*** Stocks ex Boiss., Fl. Or. 4: 145 (1875).

Description: Perennial herb, up to 40 cm. Stems branched, ± woody at base, erect to ascending, grey-green, white strigose with long tuberculate hairs intermixed with thinner shorter hairs. Leaves alternate, greyish-green, 10–40 × 5–12 mm, lanceolate to elliptic-lanceolate, base cuneate and tapering into the petiole, apex obtuse, margins entire to undulate, villose, mixed with long strigose bulbous-based hairy on both surfaces; petiole up to 2 mm long. Inflorescence terminal, simple or branched; flowers in unilateral cymes, lax in fruit; bracts absent. Calyx 5-lobed, deciduous; lobes free to base, ± 4 mm, linear-oblong, densely hairy with long and short hairs. Corolla white, tubular, 5-lobed; tube ± 4 mm, hairy on the outside; lobes small, ± 1 mm, acute, somewhat crenulated, overlapping. Stamens attached to the middle of corolla tube; stigma long (4–5 mm), subulate, divided into 2 at apex, exserted, glabrous; disc at base prominent. Nutlets 4, ovoid, separating at maturity, glabrous, rugulose.

Flowering and fruiting: August to October.

Distribution and habitat: Southern Oman, Dhofar, recorded from the eastern part of the escarpment mountains on Jebal Semhan. *Altitude*: ± 1350 m. Distributed in SW Pakistan. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 630.

Notes: The species is easily recognised by its long exserted stigmas.

4. ***Heliotropium bacciferum*** Forssk., Fl. Aegypt.-Arab.: 38 (1775) sensu lato.
Type: Yemen, Lohaja [Al Luhayyah], 1. 1763, *Forsskal* 1329 (holotype C).
Synonyms: *Heliotropium ramosissimum* (Lehm.) DC. (1845); *H. undulatum* Vahl var. *ramosissimum* Lehm. (1831); *H. kotschyi* Bunge (1869) nomen nudum; *H. tuberculosum* (Boiss.) Boiss. (1879); *H. persicum* auct.: Boiss. (1879), non Lam. (1789); *H. lignosum* Bornm. (1937) nomen nudum; *H. fartakense* O.Schwartz (1939). Type: Yemen, Hadramaut & Ras Fartak, *el Hami* S. 162, *Paulay* s.n.; *H. undulatum* sensu Schwartz (1939); *H. bacciferum* Forssk. subsp. *lignosum* (Vatke) Kazmi var. *fartakense* (O.Schwartz) Kazmi (1970).
Vernacular names: rum ram, ram ram.

Description: Perennial herb, or small shrub with woody base and woody stems, up to 60 cm, sometimes forming large spreads on low mounds 2–3 m wide composed of several shrubs. Stems simple or branched, erect to ascending to prostrate, strigose with adpressed and spreading, long and short bulbous-based hairs. Leaves alternate, 5–60 × 2–16 mm, (often larger on younger plants and seedlings), linear to linear-lanceolate to ovate-lanceolate, base tapering into a short petiole, 1–3 mm, apex acute, crenulate-undulate at margins, sometimes margins revolute, young leaves flat, mature fleshy sometimes semi-terete, both surfaces covered with long and short bulbous-based hairs, denser on the nerves and margins, dark green to blackish-green. Inflorescence terminal or axillary; flowers sessile in dense simple or branched scorpioid cymes, 1.5–3 cm, often straightening and somewhat

elongating and becoming lax in fruit. Flowers white or rarely yellow (possibly by age or drying yellowish); bracts absent. Calyx 5-lobed, persistent; lobes free almost to base, 2–2.5 mm, linear to lanceolate, hairy. Corolla tubular, 5-lobed; tube 2.5–3.5 mm, hairy outside; lobes ± 1 mm, linear-oblong, obtuse, overlapping. Stamens attached to the corolla tube, slightly above corolla base; stigma ring-shaped with a conical head. Fruit of 4 nutlets, ± rugulose on the back, glabrous or pilose, sometimes slightly winged at edges, separating into 4, 1-seeded nutlets or rarely into 2 pairs of fused nutlets.

Flowering and fruiting: February, March/April; September, October.

Distribution and habitat: Throughout Oman, including Musandam, Masirah Is., Al Hallaniyat and Al Daymaniyat Islands, in a variety of habitats from saline coastal flats to sandy and pebbly coasts, stony, sandy and gravely wadi beds and banks, hill slopes, coastal wadis, at edges of agricultural land and waste and disturbed places. *Altitude*: 30–800 m. Distributed from N Africa and the Arabian Peninsula through to Iraq, Iran, Afghanistan, Pakistan and Turkmenistan. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, Yemen, UAE (See Akhani 2007: 413, Fig. 29).

Distribution map & Illustration: 631.

Notes: Taken in the wide sense, this is one of the most common species in Oman; it is an extremely variable species, widespread in distribution, with many intermediary forms. Very variable in leaf characters (shape, margins, indumentum and succulence of leaves) and pubescence of nutlets. Plants in coastal habitats as well as in dry saline and dry sandy habitats generally tend to have linear to semi-terete, fleshy leaves but not always so. In general, the broad leaved plants with pilose nutlets have been separated as *ramosissimum* (further separated into subspecies and varieties) and the narrower, linear to linear lanceolate leaved ones with ± glabrous nutlets as *bacciferum*. The separation of nutlets at maturity has been used by some authors (Mandaville, Fl. Eastern Saudi Arabia, 1990: 252) to distinguish *bacciferum* (nutlets of 2 fused pairs) and *H. ramosissimum* (nutlets 4), although Forsskal's original description of *bacciferum* describes the fruit with 4 nutlets, without wings.

I agree with Akhani & Förther who have examined many specimens from the Flora Iranica area (Iraq, Iran, Afghanistan, Pakistan, Turkmenistan), and keep the Oman material under *H. bacciferum* sensu lato until further data becomes available. I have also included *H. fartakense* O.Schwartz under this name as a morphological variant of this large group though this inclusion must be considered tentative until the group is studied thoroughly. *H. fartakense* is described from Yemen, Hadramaut and Ras Fartak, and according to Schwartz closely related to *H. undulata* Vahl with difference in its decumbent habit, and small yellowish glossy nutlets. According to Miller & Morris (Pl. Dhofar 1988: 74) *H. fartakense* is probably endemic to southern Arabia, mainly along coasts with its characteristic short inflorescence that does not elongate. *H. bacciferum* (including *ramosissimum*), *H. fartakense*, and the next species (*H. pterocarpum*), belong to a complex group that requires further study before recognizing any new taxa.

5. ***Heliotropium pterocarpum*** (DC.) Hochst. & Steud. ex Bunge, Prodr. 9: 552 (1869).
Basionym: Heliophytum pterocarpum DC. (1845).

Species very similar in facies to *H. bacciferum*, but differing in the fruit with 4 nutlets separating into 2 halves, glabrous, each half provided with a broad wing.

Wood in Fl. Yemen (1997: 238) states that plants with broad and narrow winged nutlets are found, and Thulin in Fl. Somalia (2006: vol. 3, 49) describes the nutlets as sometimes with narrow wings. *H. pterocarpum* is part of a widespread complex of species which includes *H. bacciferum* s.l. that are in need of further study. Distribution of this species in Oman is based on a single collection and therefore information on flowering and fruiting, and distribution is incomplete.

Flowering and fruiting: February, March.

Distribution and habitat: Northern Oman, in sandy gravel, on open ground. *Altitude*: ± 30 m. Distributed in Djibouti, Sudan, Somalia, N and W Africa, Arabian Peninsula eastwards to Pakistan (fide Fl. Somalia). Elsewhere in the Arabian Peninsula recorded from Saudi Arabia, Yemen.

Distribution map & Illustration: 632.

6. ***Heliotropium ovalifolium*** Forssk., Fl. Aegypt.-Arab.: 38 (1775).
Type: Yemen, *Forsskål* s.n. (holotype C).

Description: Perennial herb, up to 40 cm. Stems branched, ± woody at base, ascending to decumbent, grey-green, covered with retrorse hairs throughout. Leaves alternate, greyish-green, 7–25 × 3–9 mm, obovate to oblong-ovate, base cuneate and tapering into the petiole, apex obtuse, margins entire, densely covered with retrorse hairs; petiole to 8 mm long. Inflorescence terminal, often paired, up to 12 cm long, flowers in scorpioid cymes; bracts absent. Calyx 5-lobed, persistent; lobes free to base, 1.5–2 mm, one lobe larger than the others, lanceolate, densely hairy. Corolla white, tubular, 5-lobed; tube ± 2.5mm, hairy on the outside; lobes small, 0.6–1 mm, rounded, overlapping. Stamens attached below the middle of corolla tube. Stigma sessile, conical. Nutlets 4, ovoid, retrorsely white hairy.

Flowering and fruiting: August to October.

Distribution and habitat: Southern Oman, Dhofar, on the lower slopes of the Dhofar mountains, in gravely and sandy wadi banks, coastal wadis, and in moist disturbed places. *Altitude*: 500–600 m. Distributed from Egypt east to west tropical Africa, Djibouti, Eritrea, Ethiopia, Somalia, Kenya, Tanzania, Angola, South Africa, Madagascar, Arabian Peninsula to Pakistan and India; introduced elsewhere. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration: 633.

Notes: Material from Yemen shows leaves up to 5 cm. Easily distinguished by the obovate grey-green leaves and often forked inflorescences.

7. ***Heliotropium strigosum*** Willd., Sp. Pl. 1(2): 743 (1798).

Description: Annual or perennial herb (Oman plants seen are perennials), up to 15 cm. Stems branched from a woody base, erect to ascending to decumbent, whitish-green to grey-green, covered with adpressed white hairs throughout; bark whitish, flaking. Leaves alternate, greyish-green, 5–11 × 1 -1.5 mm, linear-lanceolate, base shortly cuneate, apex acute, margins entire, often revolute, adpressed white hairy; petiole ± 1 mm. Inflorescence terminal, bracteate; flowers in unilateral terminal cymes (appearing spike-like); bracts ± 2 mm, linear-lanceolate; pedicels 0–1 mm. Calyx 5-lobed, persistent; lobes free to base, unequal, 1.5–2 mm, lanceolate, densely adpressed hairy. Corolla white, sometimes with a yellowish centre, tubular, 5-lobed, sparsely hairy outside; tube 1–2 mm; lobes small, ± 1 mm, ovate-oblong, acute. Stamens attached to the corolla tube; stigma conical. Nutlets ovoid, pubescent on the back with a cavity on inner face.

Flowering and fruiting: February, March/April; September, October.

Distribution and habitat: Northern Oman, in stony and gravely wadi beds and banks. *Altitude*: ± 650 m. Distributed in east and northeast and tropical Africa, Arabian Peninsula to tropical Asia and Australia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 634.

Notes: Akhani & Förther (1994) use the name *H. marifolium* Retz. (1781; type from India) for E African, Arabian, Pakistani and Indian plants, but maintain that the relationship between this, *H. strigosum* Willd. (1798; type from Ghana, name used for east and northeast African plants), and several other species (distributed in Asia and Australia) belong to a complex and variable group of species with a wide distribution range, and which requires further study. I have seen only two collections from northern Oman, but the species is fairly widespread in Saudi Arabia and Yemen.

8. ***Heliotropium rariflorum*** Stocks, J. Bot. 4: 174 (1852).

Description: Perennial herb, up to 30 cm. Stems densely branched, woody at base, erect to ascending, whitish-green to grey-green, covered with adpressed white hairs throughout; bark silvery, flaking. Leaves alternate, sessile, greyish-green, 8–25 × 1–2 mm, linear to linear-lanceolate, base shortly cuneate, apex acute, margins entire, adpressed white hairy. Inflorescence terminal; flowers in lax cymes with leaves reduced to bracts, 2–4 mm, lanceolate, or bracts absent. Calyx 5-lobed, persistent; lobes free to base, unequal, 1.5–2 mm, lanceolate, adpressed hairy, often connivent in fruit. Corolla white, tubular to campanulate, 5-lobed, sparsely hairy outside, pilose internally below the stamens; tube ± 1.5mm, hairy on the outside; lobes small, ± 1 mm, ovate-oblong, cucullate. Stamens attached to the middle of corolla tube; stigma capitate or globose, with a small tuft of hairs in the middle. Nutlets ovoid, pubescent on the back with spreading hairs, and a cavity on inner face.

Flowering and fruiting: February, March/April; September, October.

Distribution and habitat: Northern and Southern Oman, in gravely wadi beds and banks, and hill slopes amongst stones with *Euphorbia* and *Acacia*. *Altitude*: 700–1100 m. Distributed in Angola, Namibia, Kenya, Tanzania, Somalia, Ethiopia, Sudan and Egypt through the Arabian Peninsula to Iran, Afghanistan and Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 635.

Notes: Verdcourt in Fl. Trop. East Africa (1991) distinguished between subsp. *hereroense* (Schinz) Verdc. with hairs adpressed on the nutlets, found in Africa, and hairs spreading in Arabia. Thulin in Flora of Somalia, (2006: vol. 3, 51) notes that this difference does not hold good for Somali plants. All Oman material, however, is referable to subsp. *rariflorum*.

9. ***Heliotropium subspinosum*** Thulin & A.G.Miller, Nord. J. Bot. 23(5): 527 (2005).

Description: Small shrub up to 1 m. Stems much branched, often forming large cushions, ± erect to hanging, with a whitish cracked bark, covered with adpressed to spreading tubercle-based hairs; sometimes hairs reduced to subglobose bases only. Leaves alternate, greyish-green, 8(–15) × 5(–13) mm, elliptic to ovate or suborbicular, base cuneate tapering into the petiole; apex obtuse, margins entire or shallowly crenate, covered with adpressed to spreading tubercle-based hairs, venation obscure; petiole to 2.5 mm long. Inflorescence terminal, 1–4-flowered, axis up to 1(–4) cm long, rigid, becoming spinescent; flowers sessile; bracts absent. Calyx 5-lobed, persistent; lobes free to base, 1–2.5 mm, ± unequal, ovate to lanceolate, hairy without and within. Corolla yellowish, 3–4 mm, tubular, 5-lobed, pubescent outside; tube cylindrical, hairy on the outside; lobes small, 0.5–1 mm, ovate, spreading. Stamens attached below the middle of corolla tube, largely exerted. Stigma sessile, conical. Nutlets 4, ovoid, ± pubescent retrorse hairy.

Flowering and fruiting: August to September; March.

Distribution and habitat: Southern Oman, Dhofar, on coastal cliffs, on rocky and gravely hillsides, crevices of rocks. *Altitude*: 500–900 m. Distributed from north-central and north-eastern Somalia to Dhofar. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 636.

Notes: The species is quite distinct in its shrubby habit, woody stems, small leaves and axis of inflorescence that become spinescent. Described from Somalia.

10. ***Heliotropium europaeum*** L., Sp. Pl. 1: 130 (1753) sensu lato.
Synonyms: *Heliotropium ellipticum* Ledeb. (1831); *H. lasiocarpum* Fisch. & C.A.Mey. (1837); *H. strictum* Ledeb. (1847); *H. europaeum* L. var. *ellipticum* (Ledeb.) Regel (1868); *H. europaeum* L. var. *tenuiflorum* Boiss. (1879); *H. eichwaldii* Steud. var. *lasiocarpum* (Fisch. & C.A.Mey.) C.B.Clarke (1883); *H. ellipticum* Ledeb. var. *lasiocarpum* (Fisch. & C.A.Mey.) Popov (1931); *H. europaeum* L. var. *lasiocarpum* (Fisch. & C.A.Mey.) Kazmi (1970).

Description: Annual with a stout ± woody base, up to 25 cm. Stems simple or with few branches. Leaves 25–60 × 18–30 mm, ovate to ovate-elliptic, base cuneate and tapering into the petiole, sometimes oblique, apex acute, margins entire, densely adpressed tomentose with bulbous-based hairs, dense on the nerves; nerves depressed; petiole 15–45 mm. Inflorescence of terminal and lateral scorpiod cymes, flowers dense, in fruiting time biseriate, up to 10 cm, often forked; flowers compact above becoming lax below. Calyx 5-lobed, persistent; lobes free to base, 3–4 mm, oblong-lanceolate, acute, densely hairy. Corolla white, tubular, 5-lobed; tube about half times longer than the calyx, hairy on the outside; lobes small, ± 1 mm, oblong, rounded at apex, overlapping. Stamens attached just above the base of corolla tube. Stigma conical to linear (conical in most of Oman plants). Nutlets 4, ovoid, verrucose, covered with short or a few long hairs or ± glabrous.

Flowering and fruiting: February to May.

Distribution and habitat: Northern Oman, and Musandam, in gravel and sandy places, open ground, in and beside agricultural fields, along tracks. *Altitude*: 50–300(800 m). Widely distributed from Europe and Egypt eastwards through the Arabian Peninsula, Iraq, Iran, Pakistan and Central Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 637.

Notes: A polymorphic and widely distributed species where many varieties are described based on the constriction of the corolla tube at throat, bifid stigma, and verrucose pubescent nutlets (var. *lasiocarpum*), corolla tube not constricted, stigma deeply bilobed, nutlets usually glabrous or sometimes pilose, rugulose or tuberculose (var. *europaeum*). Flora of Turkey (1978: vol. 6, 252–254) recognizes *H. dolosum* DeNot., *H. ellipticum* Ledeb. and *H. lasiocarpum* as separate but closely related species with little differences in the width of calyx lobes, glabrous (*H. lasiocarpum*) or hairy stigmas (*H. dolosum, H. europaeum, H. ellipticum*), indumentum and surface of the nutlets.

The Oman and UAE material is quite variable and falls intermediate between *H. europaeum* and *H. lasiocarpum*, and also cannot be fully assigned to *H. lasiocarpum* or *H. europaeum* var. *lasiocarpum* as delimited by Kazmi. Akhani & Förther (1994: 2, 18–276) have revised the genus *Heliotropium* in the Flora Iranica area, and admit that the *H. europaeum* s.l. (including *H. europaeum* s.str., *H. dolosum*, *H. ellipticum*, *H. lasiocarpum* and *H. strictum*) cannot be satisfactorily separated into distinct taxa and therefore is best maintained as a single taxon.

NEW RECORD FOR OMAN

Heliotropium digynum (Forssk.) Asch. ex C.Chr. has recently been recorded from Northern Oman, close to the UAE border, on sandy plains and low inland dunes, in Wilayat Mahadah, growing with *Moltkiopsis ciliata* (Patzelt et al., Edinb. J. Bot. 71: 170, 2014). It is distinguished by its conspicuous bracts, small curved spikes and acute yellowish petals. Elsewhere in the Arabian Peninsula known from Saudi Arabia, UAE.

5. **Moltkiopsis** I.M.Johnst.
Monotypic; distributed from Algeria to the Arabian Peninsula and into Iran.

Moltkiopsis ciliata (Forssk.) I.M.Johnst., J. Arn. Arbor. 34: 3 (1953).
Basionym: *Lithospermum ciliatum* Forssk. (1775).

Description: Annual or perennial herb, up to 22 cm. Stems few to many arising from the base, greyish-green, ascending to decumbent to ± erect, adpressed white pubescent with short and long tubercle based hairs. Leaves alternate, 10–20 × 3–5 mm, oblong-lanceolate to ovate-lanceolate, base cuneate, apex obtuse to acute, margins entire, densely covered with adpressed to spreading hairs. Flowers in one-sided racemes, bracteate; bracts longer than calyx. Calyx ± 5 mm, 5-lobed to base; lobes linear. Corolla pink to reddish pink, ± 10 mm, tubular, densely villous outside, glabrous inside; lobes oblong, obtuse. Nutlets 2 developing, smooth and glossy.

Flowering and fruiting: December to May.

Distribution and habitat: Northern Oman, in sandy areas, towards the Oman–UAE border. *Altitude*: ± 50 m. Distributed from N Africa, Syria, Lebanon, Jordan to Iran. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration: 638.

Notes: The species is common and widespread along the Arabian Gulf coast and inland in north Emirates. It has been collected only once from Oman, but there is no reason why it should be absent from Oman, being common and widespread in the UAE. Is possibly overlooked and under-collected.

This species has been reported as one of the food plants of the spiny-tailed agama *Uromastyx microlepis* by Jongbloed (Wild Flow. United Arab Emirates 2003: 218).

6. **Ogastemma** Brummitt
Megastoma (Benth. & Hook.f.) Coss. & Durieu ex Bonnet & Barratte
Genus with a single species distributed in the Canary Islands, northern Africa and the Arabian Peninsula.

Ogastemma pusillum (Coss. & Durieu ex Bonnet & Barratte) Brummitt, Kew Bull. 36 : 679 (1982).
Basionym: *Megastoma pusillum* Coss. & Durieu ex Balansa (1853) nom. nud. ex Bonnet & Barratte (1892–1895).

Description: Annual herbs, up to 15 cm. Stems branched, erect, the lowest branches opposite, densely covered with adpressed disc-based hairs, bristly. Leaves with the lowest pair opposite, then alternate, 0.5–20 × 1.5–2 mm, lanceolate, base cuneate to attenuate, apex acute, densely covered with disc-based hairs. Flowers in terminal cymes (only one flower opening at a time), erect; pedicels ± 1 mm. Calyx about as long as the corolla, 5-lobed, lobes free, ± unequal, 2–4 mm, narrow lanceolate, adpressed disc-based hairy. Corolla

white, regular, 2–2.5 mm, ± tubular; tube ± 1.5 mm, with an invagination below each corolla lobe, 6–9 mm, glabrous; limb 5-lobed. Stamens attached at equal heights; anthers included. Ovary 4-lobed; style gynobasic, stigmas 2, globose. Nutlets light brown, ovoid, verrucose, usually 4 developing.

Flowering and fruiting: February to April; September/October.

Distribution and habitat: Northern and southern Oman, on mountains slopes and wadis, in sandy depressions in wadis, amongst rocks and stones. *Altitude*: 200–500 m. Distributed in the Canary Islands, and from Mauritania, Morocco, Algeria, Tunisia, Libya and Egypt to the Arabian Peninsula. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration: 639.

7. **Echiochilon** Desf.

A genus with 14 species distributed from Mauritania, Morocco, eastwards to Somalia and Kenya, Israel, Palestine, Jordan, the Arabian Peninsula, and Iran.
Species descriptions and key are adapted from Lönn (1999).

1. Most leaves opposite 2
   Most leaves alternate 3
2. Leaves fleshy, oblong to triangular, connate, with the base clasping; vegetative parts with densely adpressed disc-based hairs; corolla tube 3–3.5 mm .... 1. **E. jugatum**
   Leaves oblanceolate to lanceolate, base cuneate to attenuate; vegetative parts with disc-based and glandular hairs; corolla tube 7–9 mm ..... 5. **E. collenettei**
3. Flowers present along the whole branch ..... 2. **E. kotschyi**
   Flowers in cymes at the end of branches 4
4. Flowers regular or only slightly zygomorphic; few lower leaves opposite ..... 4. **E. persicum**
   Flowers zygomorphic; all leaves alternate 5
5. Corolla ± 2-lipped, the two adaxial lobes forming an emarginate upper lip, 3 abaxial lobes forming the lower lip, glabrous, rarely glandular ..... 3. **E. longiflorum**
   Corolla not 2-lipped; upper lip not emarginate, hairy and glandular 6
6. Leaves closely pressed to stem; corolla blue, rarely white, 8–9 mm, obliquely trumpet-shaped; tube 5–6.5 mm ..... 6. **E. arabicum**
   Leaves standing out from the stem; corolla white with purple waist, purple veined, obliquely funnel-shaped; tube 6–9 mm ..... 7. **E. callianthum**

1. ***Echiochilon jugatum*** I.M.Johnst., J. Arnold Arbor. 38: 282 (1957).
Type: Oman, Dhofar, Mirbat coast, 1895, *J.T. Bent* 21 (holotype K).
Vernacular names: halmit, silli.

Description: Perennial low shrub with a woody base, up to 50 cm. Stems much branched,

prostrate to ascending, densely adpressed disc-based hairy. Leaves opposite, fleshy, connate, 3.2–6 × 1.3–2.5 mm, triangular to oblong, base clasping, apex acute to subacute, usually recurving, densely adpressed hairy. Flowers solitary, axillary, more or less throughout the length of the stem; pedicel 0.5–1 mm. Calyx 3–3.5 mm, increasing in fruit, 5-lobed, lobes ovate, ± free, densely adpressed disc-based hairy. Corolla white, cream or pale yellow, funnel-shaped, 3.9–5.5 mm; tube 3–3.5 mm, lobes oblong, rounded, flat or spreading. Stamens attached at throat; anthers exserted. Nutlets whitish, 2–3 mm, ovoid, smooth, usually 1–3 developing.

Flowering and fruiting: September to March.

Distribution and habitat: Throughout Oman, in sandy areas, wadis in sand desert, sandy wadi beds in gravel desert, near coasts on low sand dunes. *Altitude*: 0–200 m. Distributed in Djibouti, Ethiopia, Somalia. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, UAE.

Distribution map & Illustration: 640.

2. ***Echiochilon kotschyi*** (Boiss. & Hohen.) I.M.Johnst., J. Arnold Arbor. 38: 283 (1957).
Basionym: *Lithospermum kotschyi* Boiss. & Hohen. (1844).

Description: Perennial low shrub with a woody base, up to ± 25 cm. Stems much branched, prostrate to ascending, densely adpressed disc-based hairy. Leaves alternate, few lower ones opposite, 4–9 × 1–2 mm, triangular to oblong, base clasping, apex acute to subacute, usually recurving, densely adpressed hairy with disc-based hairs. Flowers solitary, axillary, more or less throughout the length of the stem; pedicel 0.5–1 mm. Calyx 1–3.5 mm, increasing in fruit, 5-lobed, lobes ovate, ± free, densely adpressed disc-shaped hairy. Corolla white, cream or pale yellow, funnel-shaped, 3–5.5 mm; tube 2–3.2 mm, lobes oblong, rounded, flat or spreading. Stamens attached at throat; anthers exserted. Nutlets whitish, 2–2.5 mm, ovoid, smooth or verrucose, provided with a ventral keel, usually 2–4 developing.

Flowering and fruiting: September, October.

Distribution and habitat: Central and southern Oman, in sandy depressions in gravel desert areas, sandy wadi beds, and low coastal sand dunes. *Altitude*: 0–50 m. Distributed in Iran. Elsewhere in the Arabian Peninsula found in Qatar, UAE, Yemen.

Distribution map & Illustration: 641.

3. ***Echiochilon longiflorum*** Benth. in Hook.f., Icon. Pl. 13: 60, plate 1277 (1879).
Type: Yemen, Aden, March 1878, *W. Perry* 9 (holotype K).

Description: Annual or perennial herb, glaucous, with a ± woody base, up to ± 40 cm. Stems branched, erect, young branches finely ribbed, glabrous to hispid with disc-based or bulbous-based adpressed or spreading hairs and glandular hairs. Leaves alternate, few lower ones opposite, 3–40 × 1–9 mm, lanceolate, base cuneate to attenuate, apex acute to

obtuse, glabrous to hispid disc- or bulbous- based hairs. Flowers in elongate, erect, ± unilateral many-flowered cymes; pedicel 0.5–4 mm. Calyx less than half as long or equalling the corolla tube, 4–5-lobed, lobes unequal, ± free, 2.5–8 mm, the adaxial smallest, lanceolate, sparsely hairy. Corolla yellowish or white with a bluish tube, 12–16 mm, obliquely funnel-shaped, zygomorphic, ± 2-lipped; tube 3–10 mm, two adaxial lobes forming an emarginate upper lip, 3 abaxial lobes forming the lower lip, glabrous, rarely glandular hairy. Stamens attached at throat at ± different heights; anthers included. Nutlets reddish or greyish, 1–2 mm, cordate with a rostrate apex, tuberculate, usually 1–4 developing.

Flowering and fruiting: September/October.

Distribution and habitat: Southern Oman, Dhofar, coastal cliffs on dry rocky or gravely slopes. *Altitude*: ± 950 m. Distributed in Ethiopia and Somalia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 642.

4. ***Echiochilon persicum*** (Burm.f.) I.M.Johnst., J. Arnold Arbor. 38: 288 (1957).
Basionym: *Heliotropium persicum* Burm.f. (1768). *Synonyms*: *Sericostoma strigosa* Deflers (1896). Type: Yemen, Muhafazat Abyan, Bilad Fodhli, Jebel Urays, April 1893, *Deflers* 1075 (holotype ?P); *Sericostoma persicum* (Burm.f.) B.L.Burtt (1949); *Echiochilon strigosum* (Deflers) I.M.Johnst. (1957). Type as for *Sericostoma strigosa*; *E. thesigeri* I.M.Johnst. (1957). Type: Oman, Jebal Hafit, 25 April 1948, *Thesiger* s.n. (holotype BM).

Description: Perennial herb with a woody base, up to 35 cm. Stems branched, ± erect to ascending, hispid with disc-based hairs. Leaves alternate, few lower ones opposite, 2–17 × 0.5–2 mm, oblong, narrow oblanceolate to oblanceolate, base cuneate to attenuate, apex acute to obtuse, patent, covered with disc-based hairs, ± glandular. Flowers in well developed cymes, erect; pedicels 0.5–1 mm. Calyx about half as long or equalling the corolla tube, 5-lobed, lobes ± unequal, ± free, 1.7–4.2 mm, one of the abaxial the largest, lanceolate to oblanceolate, adpressed disc-based hairy. Corolla yellowish, rarely bluish, 2.7–7 mm, funnel-shaped, regular or somewhat zygomorphic; tube 2–5 mm, ± hairy and ± glandular, limb flat or cup-shaped with erect or spreading lobes. Stamens attached at throat at ± different heights; anthers included or exserted. Nutlets whitish or reddish or greyish, 1.5–2.5 mm, with a rostrate apex, keeled on the ventral side, verrucose, 1–4 developing.

Flowering and fruiting: February to May; September/October.

Distribution and habitat: Throughout Oman, and Musandam, and off shore islands, in gravely, sandy and stony places, gravel plains, wadis; on coastal cliffs and plains in Dhofar. *Altitude*: 0–2500 m. Distributed from Sudan, Djibouti, Somalia through the Arabian Peninsula to Iran and Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 643.

Notes: A widespread and variable species with several forms throughout its range of distri-

bution. According to Lönn (1999) the form that agrees with the type is found in the Arabian Peninsula including Soqotra, Iran, Pakistan and Sudan. In Yemen, Saudi Arabia and Sudan it is more strigose than in Oman and Iran, where it is more hairy. Intermediates exist especially in Saudi Arabia.

5. ***Echiochilon collenettei*** I.M.Johnst., J. Arnold Arbor. 38: 277 (1957).

Description: Low shrub with a woody base, sometimes cushion-forming, up to 25 cm. Stems much branched, with many short shoots in leaf axils, erect to ascending, covered with adpressed disc-based and sessile to stalked glandular hairs. Leaves opposite, 3.5–11.5 × 1–2 mm, oblanceolate to lanceolate, base cuneate to attenuate, apex acute, covered with scattered disc-based and glandular hairs. Flowers in short cymes, erect; pedicels 0.7–1.7 mm. Calyx about half as long or equalling the corolla tube, 5-lobed, lobes ± unequal, ± free, 3–5 mm, adpressed disc-based hairy and densely glandular. Corolla yellow or white, 9–11 mm, funnel-shaped, regular or somewhat zygomorphic; tube 7.5–9 mm, hairy and glandular, limb with rounded lobes. Stamens attached at throat at equal heights; anthers included. Nutlets reddish-brown, ± 2 mm, with a rostrate apex, keeled on the ventral side, tuberculate, 2–3 developing.

Flowering and fruiting: February to May; September/October.

Distribution and habitat: Southern Oman, Dhofar in stony and gravely places, in the mountains, in the *Acacia–Commiphora* shrub land. *Altitude*: 80–550 m. Distributed in northern Somalia. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 644.

Notes: Collected only once from the drier areas of the southern mountains. The species is noted to have a disjunct distribution but maintains a uniformity in characters throughout its range. The species comes closest to *E. arabicum* and *E. persicum*; from the former it differs in its regular corolla and from the latter in its longer corolla tube and most of the leaves being opposite.

6. ***Echiochilon arabicum*** (O.Schwartz) I.M.Johnst., J. Arnold Arbor. 38: 289 (1957).
Basionym: *Teraedrocarpus arabicus* O. Schwartz (1939). Type: Yemen, Hadramaut, Wadi Himam, May 1931, *Wissmann* 1234 (lectotype HBG).

Description: Perennial herb with a ± woody base, up to 45 cm. Stems branched, erect to ascending, covered with adpressed disc-based hairs and sessile to stalked glandular hairs. Leaves alternate, 11–36 × 3–7 mm, oblanceolate, base cuneate to attenuate, apex acute, closely appressed to the stem, covered with disc-based hairs. Flowers in well developed cymes, erect; pedicels 1–1.5 mm. Calyx about half as long as the corolla tube, 5-lobed, lobes ± unequal, ± free, 3–5 mm, one of the abaxial ones largest, adpressed disc-based hairy and densely glandular. Corolla blue, rarely white, 8–9 mm, zygomorphic, obliquely trumpet-shaped; tube 5–6.5 mm, hairy and glandular, limb with spreading rounded lobes. Stamens attached at throat at different heights; anthers included. Nutlets reddish-brown to

light brown, ± 2 mm, ovoid, with a rostrate apex, keeled on the ventral side, tuberculate, 2–4 developing.

Flowering and fruiting: September to May.

Distribution and habitat: Southern Oman, Dhofar on open stony and rocky ground, wadi beds and hill slopes. *Altitude*: 80–350 m. A regional endemic found in SE Yemen and SW Oman. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 645.

7. ***Echiochilon callianthum*** Lönn, Bot. J. Linn. Soc. 130: 246 (1999).

Description: Perennial herb with a ± woody base, up to 40 cm. Stems branched, erect to ascending, covered with spreading to adpressed disc-based hairs and stalked glandular hairs. Leaves alternate, 15–17 × 2–3 mm, oblanceolate, base cuneate to attenuate, apex acute, patent, covered with disc-based hairs. Flowers in well developed cymes, erect; pedicels 1–1.5 mm. Calyx about half as long as the corolla tube, 5-lobed, lobes ± unequal, ± free, 5–8 mm, one of the abaxial ones largest, adpressed disc-based hairy. Corolla white with purple waist, purple veined, 9–12 mm, strongly zygomorphic, obliquely funnel-shaped; tube 6–9 mm, hairy and glandular, limb with spreading rounded lobes. Stamens attached at throat at different heights; anthers included. Nutlets reddish-brown to light brown, ± 2 mm, ovoid, with a rostrate apex, keeled on the ventral side, smooth to tuberculate, 1–4 developing.

Flowering and fruiting: February to April; September/October.

Distribution and habitat: Northern and southern Oman, on open stony and gravelly places, wadis, hill slopes and wadi beds. *Altitude*: 80–350 m. A regional endemic found in SE Yemen and SW Oman. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 646.

8. **Lappula** Moench

Heterocaryum A.DC.

About 50 species distributed in the north temperate and sub-tropical regions, south to North Africa, Arabia, India; also in Chile and Argentina.

Lappula spinocarpos (Forssk.) Asch. ex Kuntze, Trudy Imp. S.-Peterburgsk. Bot. Sada. 10(1): 215 (1887).

Basionym: *Anchusa spinocarpos* Forssk. (1775). Type: Egypt, Alexandria, *Forsskal* 304 (holotype C).

Synonyms: *Echinospermum spinocarpos* (Forssk.) Boiss. (1875); *Sclerocaryopsis spinocarpos* (Forssk.) Brand (1931).

Description: Annual herb, up to 15 cm. Stems ± erect, greyish-green, stout, branching divaricately, adpressed to spreading pubescent. Leaves alternate to subopposite, 10–20 × 1–2 mm, lanceolate to oblanceolate, base cuneate, apex obtuse, margins entire, pubescent

with adpressed and spreading hairs. Flowers in terminal cymes; pedicels up to 5 mm in fruit. Calyx 5-lobed to base, accrescent in fruit, lobes ± 4 mm (smaller in flower), lanceolate-oblong, adpressed hairy with tubercule-based hairs. Corolla blue, funnel-shaped, limb 5-lobed with rounded lobes. Appendages present in throat. Style gynobasic. Nutlets ovoid-triangular, aculeate, tuberculate.

Flowering and fruiting: March/April.

Distribution and habitat: Northern Oman, on the western Hajar mountains, and Musandam, on wadi banks and on the summit plateau, amongst rocks and stones. *Altitude*: 300–1300 m. Distributed from North Africa, Sudan, Egypt, Syria, through the Arabian Peninsula, Iraq, Iran to Central Asia, Afghanistan and Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia.

Distribution map & Illustration: 647.

Notes: Recorded as rare on the Musandam Peninsula from Jiddat al Sahasa, but being an annual possibly under-collected.

9. **Rochelia** Rchb.

About 20 species distributed from Spain and North Africa east to the Middle Asia, western China and western Himalayas.

Rochelia disperma (L.f.) C.Koch, Linnaea 22: 649 (1849), emend Karyagin, ISV. Akad. Nauk. Azerb. URSS 12: 13, 14 (1945).
Basionym: *Lithospermum dispermum* L.f. (1762).

Description: Delicate annual, up to 15(–20) cm. Stems few to many arising from the base, greyish-green, ascending to decumbent to ± erect, adpressed white pubescent. Basal leaves 5–15 × 1–5 mm, lanceolate to oblanceolate, base cuneate, apex obtuse to acute, margins entire, densely covered with adpressed to spreading hairs; cauline leaves smaller and narrower. Flowers in one-sided racemes, bracteate; pedicels 1.5–3 mm, deflexed in fruit. Calyx 4–5 mm, 5-lobed to base, lobes oblong, exceeding the nutlets, pubescent, incurved in fruit. Corolla pale blue, 2 mm, campanulate, lobes obtuse. Style gynobasic. Nutlets placed obliquely, tuberculate.

Flowering and fruiting: March/April.

Distribution and habitat: Northern Oman, on the Hajar mountains, in runnels and in wadi beds, in small patches of sand and silt, and in silt pockets amongst stones. *Altitude*: 1800 m. Distributed from the Mediterranean, Turkey, Syria, Lebanon, Jordan to Sudan, and from Iraq, Iran, Central Asia, Afghanistan, Pakistan to Ladakh. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 648.

Notes: Only recorded once or twice from the western Hajar mountains from Wakkan, but being an annual possibly overlooked.

10. **Asperugo** L.
Monotypic; distributed in Europe and North Africa east to south Siberia, western China and the Himalayas.

Asperugo procumbens L., Sp. Pl.: 138 (1753).

Description: Annual herb. Stems striate, ascending, simple or branched, up to 2 m, hispid setose with adpressed hairs. Leaves 20–80 × 6–19 mm, oblanceolate to broadly lanceolate, base tapering, apex acute, margins entire, white hispid with bulbous-based hairs. Flowers solitary or paired, axillary; pedicels 2–4 mm. Calyx ± 2 mm, nodding in fruit; lobes 5, divided almost to base, linear-lanceolate, nervose, accrescent, increasing in size and becoming folded, and enveloping the fruit. Corolla blue, 2–4 mm, 5-lobed; tube cylindrical; lobes as long as tube, broadly rounded. Nutlets 4, laterally compressed, minutely tuberculate.

Flowering and fruiting: December to May.

Distribution and habitat: Northern Oman, on the western Hajar mountains, and Musandam, amongst rocks and stones and at edges of cultivation. *Altitude*: 1000–1300 m. Distributed in Europe, North Africa, Iran to Tibet. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration: 649.

Notes: I have collected this species only once near the village of Wakkan on the Jebel Akhdar range (Western Hajar mountains). It was common but extremely localized; there has been a lot of road and parking area development near the village and I am not sure if it still exists there.

11. **Paracaryum** (A.DC.) Boiss.
Microparacaryum (Popov ex Riedl) Hilger
About 20 species distributed in SW Europe, the Middle East, Egypt east to western China and western Himalayas.

Leaves 20–45 × 3–5 mm; petiole < 10 cm ..... 1. **P. intermedium**
Leaves (5–)15–20 × (3.5–)15–19 cm; petiole ± 12 cm ..... 2. **P. caelestinum**

1. ***Paracaryum intermedium*** (Fresen.) Lipsky, Acta Hort. Petrop. 26(2): 487 (1910).
Basionym: *Cynoglossum intermedium* Fresen. (1834). *Synonym*: *Microparacaryum intermedium* (Fresen.) Hilger & Podlech (1985).

Description: Annual herb, 15–20 cm. Stems ± erect, ± branched, pubescent with hairs arising from a tuberculate base. Leaves 20–45 × 3–5 mm, decreasing in size upwards, base cuneate, tapering into the petiole, apex obtuse, margins entire, adpressed pubescent with tubercule-based hairs. Flowers in lax racemes, bracteate; pedicels ± 2 mm, lengthening to 10 mm in fruit. Calyx 5-lobed to base, lobes ± 1.5 mm, lengthening to ± 3 mm in fruit, lanceolate- ovate, acute. Corolla deep blue with a white centre, 2–3 mm, ± campanulate, with

appendages in throat. Nutlets ± globose, 3–4 mm in diameter, margin broadly winged with a small aperture, membranous, inner margin denticulate or smooth, pubescent, central area smooth or with glochidiate appendages.

Flowering and fruiting: March/April.

Distribution and habitat: Northern Oman and Musandam, in the foothills and mid altitudes of the Hajar and Musandam mountains, in sandy depressions between stones, wadis beds and base of runnels. *Altitude*: 1000–1600 m. Distributed from Egypt, Ethiopia, Somalia, through Jordan, Palestine, Syria, Arabian Peninsula to Iran, Iraq, Pakistan, Afghanistan and Central Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration: 650.

2. ***Paracaryum caelestinum*** Benth. & Hook.f., Gen. Pl. 2(2): 850 (1876).

Description: Annual or perennial herb, 1–1.5 m. Stems erect, branched, sparsely hairy with tuberculate based hairs, the younger branches more so. Leaves alternate, large, (5–) 15–20 × (3.5–) 15–19 cm, base cuneate, tapering into the petiole, apex obtuse, margins entire, adpressed pubescent with tubercule-based hairs; petiole ± 12 cm. Flowers in paired inflorescences, up to 9 cm long; pedicels recurved in fruit. Calyx ± 5 mm, 5-lobed to base, lobes ovate-lanceolate. Corolla white with a blue centre, ± campanulate, lobes 5 mm, spreading, with appendages in throat. Ovary gynobasic, stigma capitate. Nutlets ± globose, ± 2 mm, margin winged, inner margin, denticulate, central area with whitish glochidiate spines.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in woodland and amongst shady thickets with *Anogeissus dhofarica*, *Commiphora* and *Rhus somalensis*. *Altitude*: 600–800 m. Widely distributed in tropical Africa, Ethiopia, Eritrea, Somalia, SW Arabian Peninsula to Pakistan and India, Malaysia and China. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 651.

Notes: Not common in Dhofar, but easily recognized by its large leaves and paired inflorescences.

12. **Arnebia** Forssk.

A genus with 25–30 species distributed in southern Greece and North Africa eastwards to West China, Mongolia and Himalaya and south from northern Nigeria and Chad to Somalia.

Arnebia hispidissima (Sieber ex Lehm.) DC. Prodr. 10: 94 (1846).

Basionym: *Lithospermum hispidissimum* Sieber ex Lehm., Icon. Nov. Stirp. 1: 23, t. 39 (1821). *Synonym*: *Anchusa hispidissima* Del. (1813) nom. nud.

Description: Annual or rarely perennial herb with a woody base. Stems erect to ascending, branched, 5–25 cm, covered with hispid, long ± adpressed and short hairs. Leaves alternate,

10–50 × 2–7 mm, lanceolate or linear-lanceolate, base tapering or shortly petiolate, apex acute, margins entire, white hispid. Flowers in short cymes; bracts linear-lanceolate. Calyx 5–8 mm, increasing in length; lobes 5, divided almost to base, linear. Corolla yellow, 10–15 mm, 5-lobed, hairy outside, glabrous or hairy inside; tube cylindrical; lobes a third of the tube, broadly rounded. A ring like hairy nectary present at base of corolla tube. Stamens 5. Nutlets 4, smooth or warty.

Flowering and fruiting: December to May.

Distribution and habitat: Throughout Oman, on sandy plains, in the swales of larger sand dunes, and in sandy depressions in gravely desert plains. *Altitude*: 50–200 m. Distributed in N and NE Africa, the Arabian Peninsula, and from Iraq, Iran to Tibet. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 652.

Notes: The roots give a blue dye.

13. **Trichodesma** R.Br.

About 35 species distributed from Africa (including the west Indian Ocean Islands), Western Asia and Middle Asia east to Taiwan and south to Australia.

1. Calyx lobes ovate, deeply cordate at base, enlarging in fruit up to 30 mm and enveloping the fruit ..... 3. **T. hildebrandtii**
   Calyx lobes truncate to subcordate at base, not enlarging to 30 mm nor enveloping the fruit 2
2. Whole plant densely woolly pubescent ..... 4. **T. cinereum**
   Whole plant pubescent, not woolly pubescent 3
3. Leaves ovate to broadly ovate, base rounded to subcordate, pubescent between adpressed tubercule-based hairs; calyx 4–5 mm; nutlets with white dentate glochidiate margins ..... 2. **T. ehrenbergii**
   Leaves ovate-lanceolate to ovate-oblong to linear, base rounded to cuneate, spreading tubercule-based hairy; calyx 6–9 mm; nutlets with whitish tuberculate margins .... 1. **T. africanum**

1. ***Trichodesma africanum*** (L.) Sm., Cycl. (Rees) 36: Trichodesma no. 2 (1817).
Basionym: *Borago africana* L. (1753). *Synonym*: *Borago verrucosa* Forssk. (1775).

Description: Annual or biennial herb, up to 40 cm. Stems branched from the base, erect, rigid, greyish-green, covered with white tubercule-based long stiff spreading hairs, becoming glabrescent. Leaves opposite, dull greyish green, 20–35 × 9–9 mm, ovate-lanceolate to ovate-oblong to linear, base rounded to cuneate, apex acute or obtuse, margins entire, spreading tubercule-based hairy; petiole up to 20 mm; upper leaves sessile. Flowers in lax few-flowered cymes, nodding; pedicels variable in length, developing later. Calyx 6–9 mm,

up to 10 mm in fruit, 5-lobed to base, lobes ovate-lanceolate, base truncate to subcordate, acute, hairy mainly on margins and nerves. Corolla whitish or bluish, sometimes with purple blotches in centre, tubular, tube as long as calyx, 5-lobed above with spreading lobes; lobes ovate, acuminate. Stamens 5, attached at the throat of the corolla tube, anthers ± 10 mm long, densely hairy, with long awns, exserted from the corolla and awns twisted around each other. Style gynobasic. Nutlets 4, ovoid, margins with whitish tubercles, surfaces with few tubercles.

Flowering and fruiting: August to September.

Distribution and habitat: Northern and Southern Oman, in the foothills of the Hajar mountains, in Dhofar on the drier regions of the escarpment mountains, in dried wadi beds, in *Acacia-Commiphora* shrub land. Distributed in most parts of Africa, from Sudan, Egypt, Ethiopia, Palestine, Jordan, Israel through the Arabian Peninsula to Iran and Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 653.

Notes: A widespread species varied in its vegetative characters. Several subspecies are recognised. Oman plants are referable to subsp. *africanum*.

2. ***Trichodesma ehrenbergii*** Schweinf. ex Boiss., Fl. Orient. 4(2): 281. (1879).
Synonyms: *Trichodesma ehrenbergii* Schweinf. (1869) nom. nud.; *Borago arabica* Ehrenb. ex Boiss. (1879); *Trichodesma africanum* L. var. *ehrenbergii* (Schweinf. ex Boiss.) Post (1896); *T. bentii* Baker & C.H.Wright (1905); *T. enetotrichum* R.R.Mill. in sched.

Description: Annual or biennial herb, up to 50 cm. Stems branched from the base, greyish-green, covered with white tubercule-based long stiff spreading hairs. Leaves opposite, 2–6 × 1–3.5 cm, ovate to broadly ovate, base rounded to subcordate, apex acute or obtuse, margins entire, pubescent between adpressed tubercule-based hairs; petiole up to 2.5 cm; upper leaves sessile. Flowers in lax cymes, nodding in fruit; pedicels slender variable in length, developing later. Calyx 4–5 mm, enlarging to 7 mm in fruit, 5-lobed to base, lobes ovate-lanceolate, acute, hairy mainly on margins and nerves. Corolla whitish or pale blue to violet with brown blotches in centre, tubular, tube yellow, as long as calyx, 5-lobed above with spreading lobes; lobes ovate, long acuminate. Stamens 5, attached at the throat of the corolla tube, anthers ± 10 mm long, densely hairy, with long awns, exserted from the corolla and awns twisted around each other, glabrous. Style gynobasic. Nutlets 4, 4–5 mm, ovoid, margins white dentate glochidiate, surfaces with few tubercles.

Flowering and fruiting: February to April/May.

Distribution and habitat: Northern Oman, on the Hajar mountains, on the Jebel Akhdar range, in the foothills, in gravely plains and wadis. *Altitude*: 150–1400 m. Distributed in Sudan, Egypt, Jordan, Palestine. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 654.

3. ***Trichodesma hildebrandtii*** Gurke, Notizbl. Bot. Gart. Berlin 1: 61 (1895).
Synonyms: *Trichodesma cardiosepalum* Oliv. (1895). Type: Oman, Dhofar, *J.T. Bent* 115 (holotype K); *T. arabicum* Bak. ined.

Description: Perennial herb, woody at base, up to 50 cm. Stems branched, erect, greyish-green, covered with white tubercule-based hairs and short hairs; older stems with a flaking bark. Leaves opposite, 15–65 × 5–25 mm, ovate to oblong-ovate, base rounded to cuneate, apex acute or obtuse, margins entire, adpressed tubercule-based hairy; petiole up to 5 mm. Flowers in lax few-flowered cymes, nodding; pedicels 10–15 mm. Calyx ± 10 mm, 5-lobed to base, lobes ovate, acuminate, base deeply cordate, enlarging in fruit up to 30 mm, spreading or adpressed hairy. Corolla white with yellow-brown blotches at throat, tubular, tube 8 mm, 5-lobed above with spreading lobes; lobes ovate, acuminate. Stamens 5, attached in the corolla tube, anthers ± 10 mm long ending in narrow hairy appendages, exserted from the corolla and twisted around each other. Style gynobasic. Nutlets 4, ovoid, margins denticulate, surfaces tuberculate, enveloped by the enlarged calyx.

Flowering and fruiting: August to September.

Distribution and habitat: Southern Oman, Dhofar, throughout the drier regions, along the coasts on coastal cliffs, coastal plains, dried wadi beds, and on the summit of the mountains, in *Acacia–Commiphora* shrub land. *Altitude*: 100–900 m. Distributed in Kenya, Somalia, Ethiopia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 655.

4. ***Trichodesma cinereum*** Mosti & Selvi, Candollea 62(2): 206 (2007).
Type: Oman, Dhofar, Qaftawat Wanat road, 1059 m, 1 March 2007, *M. Raffaelli, M. Tardelli & S. Mosti* s.n. (holotype FT; isotype G.)
Synonyms: *Trichodesma dhofaricum* Ghaz., Kew Bull. 65: 97–100 (2010). Type: Oman, Dhofar, Aqabat Mushaylah, on road to Wadi Haluf, 690 m, 11 Oct. 1977, *A. Radcliffe-Smith* 5459 (holotype K); *Trichodesma laecophilum* R.R.Mill. in sched.

Description: Perennial herb, up to 40 cm. Stems woody at base, simple or branched, grey-green, covered with dense white-woolly hairs interspersed with few bristly white tuberculate-based long ± adpressed hairs; bark peeling and flaking at the lower parts of stems. Leaves opposite, 25–40 × 6–18 mm, elliptic to ovate-elliptic, base cuneate and tapering into the petiole, apex acute, margins entire, densely white-woolly interspersed with few bristly white tubercle-based long ± adpressed hairs; petiole up to 25 mm; upper leaves sessile. Flowers in lax cymes, ± nodding in fruit; pedicels slender, variable in length, developing to 15 mm. Calyx 10–12 mm, enlarging to ± 15 mm in fruit, 5-lobed to base, lobes ovate-lanceolate, acute, densely white villous. Corolla pale violet to mauve, yellowish in centre, tubular; tube yellowish, 5–6 mm, shorter than calyx, 5-lobed above with spreading lobes, glabrous outside, hairy about the middle; lobes ovate, long acuminate, tips twisting. Stamens 5, attached at middle of corolla tube; anthers ± 5 mm long, densely velvety, with long apical appendages exserted from the corolla and twisted around each other, glabrous.

Style gynobasic, slender; stigma capitate. Nutlets 4, 4–5 mm, ovoid, margins inflexed, white dentate glochidate, inner surfaces glochidiate with few tubercles.

Flowering and fruiting: September to November.

Distribution and habitat: Southern Oman, Dhofar, in the drier region, in gravely wadi beds and rocky slopes. *Altitude*: 650–960 m. Endemic to Dhofar; not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 656.

Notes: This species comes closest to *Trichodsma boissieri* Post, endemic to Palestine, the Lower Jordan valley and North West Saudi Arabia, resembling it in its nutlets with inflexed margins, but differing in its narrower leaves, (12–22 mm wide in *T. boissieri*) and smaller nutlets with white dentate glochidate margins (nutlets 10 × 7 with rugose margins in *T. boissieri*). *T. cinereum* is a smaller plant than *T. boissieri* and is densely woolly throughout.

The species is not common and is found at two locations. Due to rapid development, road building and accessibility in the Hasik and Wadi Ayun areas where this species occurs, it is assessed here as Vulnerable, [VU B2 b (iii)] on the IUCN Red List.

14. **Gastrocotyle** Bunge

One or two species; distributed in Northern Africa, Arabia to W China and NW Himalaya.

Gastrocotyle hispida (Forssk.) Bunge, Mém. Acad. Imp. Sci. St.-Pétersb. Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 7: 405 (1854).
Basionym: *Anchusa hispida* Forssk. (1775).

Description: Annual herbs, up to 30 cm. Stems greyish, branched from base, erect to spreading, strigose with disc-based hairs. Leaves alternate, somewhat fleshy, 4–9(–12) × 2–6 cm, oblong to lanceolate-oblong, base cuneate, apex obtuse, margins obscurely dentate, hispid to strigose with disc-based hairs. Flowers solitary, axillary; pedicels ± 2 mm. Calyx 1.5–2.5 mm, increasing to 3 mm at fruiting, 5-lobed; lobes free, lanceolate, densely strigose inside and outside. Corolla blue or purple, 2–2.5 mm, tubular with appendages at throat; densely short strigose outside; limb 5-lobed; lobes rounded; appendages pilose. Stamens 5, included. Ovary 4-lobed; style gynobasic, stigmas capitate. Nutlets light brown, ovoid, usually 4 developing; basal ring with denticulate margins.

Flowering and fruiting: December to January.

Distribution and habitat: Northern Oman, in and at edges of irrigated fields, in sandy and silty soil, and Musandam from the limestone plateau of Jebal Harim. *Altitude*: 300–1500 m. Distributed from the Arabian Peninsula and Afghanistan through to Pakistan and N and W India to China. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration: 657.

NEW RECORDS FOR OMAN

Buglossoides tenuiflora (L.f.) I.M.Johnst. has recently been recorded from Musandam, Jebal Harim, Sahil Al Sahosa, on rocky limestone plateau (Patzelt et al., Edinb. J. Bot. 71: 169, 2014). Elsewhere in the Arabian Peninsula known from Saudi Arabia.

Heterocaryum szovitsianum (Fisch. & C.A.Mey.) A.DC. has recently been recorded from Musandam, Jebal Harim, Sahil Al Sahosa, on rocky limestone plateau with *Cymbopogon jwarancusa*. (Patzelt et al., Edinb. J. Bot. 71: 170, 2014). Elsewhere in the Arabian Peninsula known from Saudi Arabia.

76. **Verbenaceae**

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Thulin, M. (2005). Three new species of *Chascanum (Verbenaceae)* and notes on the genus in the Horn of Africa region. *Nordic J. Bot.* 23. 513–517.

The Verbenaceae are considered to be closely related to Lamiaceae (Labiatae) and the border between these two families has long not been clear. According to recent phylogentic studies several genera included in the Verbenaceae have been moved to Lamiaceae. *Premna*, *Vitex* (the latter cultivated and naturalised in some locations in Oman), and *Clerodendrum* (cultivated in Oman), are transferred to the Lamiaceae (also in this Flora). *Avicennia*, sometimes placed in Verbenaceae or in its own monogeneric family Avicenniaceae (as in this Flora), is now included in the Acanthaceae.

Key the genera of Verbenaceae in Oman

1. Flowers in dense heads or spikes 2
   Flowers in terminal or axillary racemes or spikes, not dense 3
2. Herbs with prostrate stems, rooting at nodes; pubescence of medifixed hairs; corolla 4-lobed, actinomorphic; fruit of nutlets enclosed by the persistent calyx . 3. **Phyla**
   Shrub; pubescence not of medifixed hairs; corolla 4–5-lobed, slightly 2-lipped; fruit ± fleshy drupe ..... 4. **Lantana**
3. Corolla tube often curved, exceeding the calyx; fruiting calyx oblong; fruit of 2, 1-seeded linear-oblong nutlets ..... 1. **Chascanum**
   Corolla tube straight, hardly exceeding the calyx; fruiting calyx rounded to obcordate; fruit of 2, 2-seeded nutlets, spiny, tuberculate at back ..... 2. **Priva**

1. **Chascanum** C.Mey. (*nom. cons.*)

Svensonia Moldenke (1936).

About 28 species distributed from Guinea east to Somalia, south to South Africa and west to Angola, Madagascar, the Arabian Peninsula, Pakistan and India.

Chascanum sessilifolium (Vatke) Moldenke, Phytologia 1: 18 (1933).
Basionym: *Bouchea sessilifolium* Vatke (1882).

Description: Perennial herb with erect to ascending stems up to 20 cm, puberulous with long spreading hairs. Leaves ± 2 × 1 cm, obovate to oblanceolate, base cuneate to attenuate, apex rounded, margins dentate. Flowers adpressed to the axis, in long terminal slender spikes up to 12 cm; bracts 2–3 mm, lanceolate. Calyx 6–7 mm, tubular, puberulous. Corolla cream to yellow to yellowish-red, tubular, 5-lobed above; tube 13–16 mm, curved, glabrous outside, pubescent within; lobes ± 3 mm, rounded. Stamens 4, inserted in the upper part of the corolla tube. Nutlets 2, ± 4mm long, black when ripe, reticulate in the apical part.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the lower altitudes of the escarpment mountains, and in wadis. *Altitude*: 100–350 m. Distributed in northern Somalia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 658.

2. **Priva** Adans.
About 20 species distributed from tropical Africa to South Africa and Madagascar, tropical Arabian Peninsula, southern India; also Florida and Caribbean, and Mexico to Paraguay.

Priva adhaerens (Forssk.) Chiov., Bull. Soc. Bot. Ital. 1923: 115 (1923).
Basionym: *Ruellia adhaerens* Forssk. (1775). Type: Yemen, Al Hadiyah, *Forsskal* 1814 (holotype C). *Synonyms*: *Verbena forskalaei* Vahl (1794). Type as above; *Priva cordifolia* (L.f.) Druce (1917).
Vernacular name: hamshed.

Description: Perennial herb with erect stems up to 50 cm, puberulous and with long hooked hairs. Leaves 1.5–15 × 1–10 cm, elliptic to ovate, base cuneate to attenuate, apex rounded, margins crenate-serrate; petiole 0.5–4 cm. Flowers in long terminal slender spikes up to 50 cm; bracts 2–4 mm, lanceolate; pedicels 1–2 mm. Calyx 6–8 mm, tubular, puberulous. Fruiting calyx rounded to ± obcordate, beaked. Corolla white to purple, tubular, unequally 5-lobed above; tube ± 10 mm, straight, pubescent outside; lobes ± 3–4 mm, rounded. Stamens 4, inserted in the upper part of the corolla tube, included. Nutlets 2, ± 5mm long, ± reticulate and with rows of tubercles or curved or straight spines on the back.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, in the escarpment woodlands, on the summit. *Altitude*: ± 900 m. Distributed in Djibouti, Ethiopia, Eritrea, Sudan, Somalia, Egypt, Kenya, Tanzania. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 659.

3. **Phyla** Lour.

Some six species distributed mainly in America; one widespread in the warmer regions of the world.

Phyla nodiflora (L.) Greene, Pittonia 4: 46 (1899).
Basionym: *Verbena nodiflorum* L. (1753).
Vernacular name: herum dezum (Jibbali).

Description: Perennial herb with prostrate stems rooting at nodes, forming think mats in moist places, angular, up to 50 cm, puberulous with medifixed hairs. Leaves opposite, sessile, 0.5–5 × 0.2–3 cm, obovate to oblanceolate, base cuneate to attenuate, apex rounded, margins crenate-serrate in the apical part, pubescent. Flowers in dense, pedunculate, ovate to cylindrical, bracteolate spikes 5–20 mm long; peduncle 0.5–8 cm; bracts 2–3 mm, ovate, acute. Calyx membranous, ± 1.5 mm, 2-lobed. Corolla white to pink, or pale purple, centre yellow, + 2-lipped, tubular, unequally 5-lobed above, the lowest lobe largest; tube ± 1.5 mm; lobes ± 0.4 mm, rounded. Stamens 4, inserted in the upper part of the corolla tube, included. Nutlets 2, enclosed by the persistent calyx.

Flowering and fruiting: More or less throughout the year.

Distribution and habitat: Northern, Central and Southern Oman, in shaded and moist locations, edges of *falaj* and permanent pools, date gardens and other cultivated and moist disturbed areas, saline plains in moist and wet mud, and by roadsides mainly in Dhofar; widespread and common. *Altitude*: 20–900 m. Distributed in northeast and tropical Africa, and other warm temperate and subtropical regions. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 660.

4. **Lantana** L.

About 150 species distributed mainly in tropical and subtropical America.
Lantana camara is widely cultivated as a roadside shrub, in public parks and private homes. It is also found as an escape especially on the Salalah plains. It is readily recognized by its pink to magenta flowers with a yellow centre, and prickly stems.

1. Stems prickly (cultivated and sometimes found as an escape) ..... **L. camara**
   Stems not prickly 2
2. Bracts ovate ..... 1. **L. viburnoides**
   Bracts ovate-lanceolate, very densely white pubescent ..... 2. **L. petitiana**

1. ***Lantana viburnoides*** (Forssk.) Vahl, Symb. Bot. 1: 45.(1790).
Basionym: *Charachera viburnoides* Forssk. (1775). Type: Yemen, Jebel Barad, *Forsskal* 323, 1086, 1087 (syntypes C).

Description: Shrub to 1 m. Stems 4-angled, hispid with retrorse adpressed, bulbous-based

hairs. Leaves opposite, mid-green above, greenish-white beneath, 2–4 × 0.5–3 cm, ovate, base truncate to sometimes cuneate, apex obtuse, margins dentate, hispid, veins prominent beneath; petiole 2–5 mm (in material from Saudi Arabia). Flowers in axillary condensed bracteolate spikes up to 2 cm long, cylindrical; peduncle 10–20 mm, elongating in fruit; bracts 5–6 mm, broadly ovate with acuminate tip. Calyx membranous, ± 3 mm, pubescent. Corolla pink fading white, ± 2-lipped, tubular, unequally 5-lobed above; tube ± 3 mm, slightly dilated above, pubescent. Stamens 4, included. Fruit a fleshy drupe, ± 3 mm, black when ripe, enclosed by the persistent calyx.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in *Anogeissus* woodland with *Cadia*, *Commiphora* and other species. *Altitude*: 600–1000 m. Distributed in northeast and tropical Africa, and other warm temperate and subtropical regions. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 661.

Notes: Material identified as *Lantana rugosa* Thunb., *L. salviifolia* L. and *L. rhodesiensis* Moldenke from Oman are referable to *L. viburnoides*.

2. ***Lantana petitiana*** A.Rich., Tent. Fl. Abyss. 2: 169 (1847).
Vernacular name: sif sif.

Description: Low shrub to 1 m with many shoots, often heavily grazed. Stems hispid with retrorse adpressed, white hairs. Leaves opposite, grey-green above, greenish-white beneath, 5–22(–30) × 3–11(–13) mm, ovate to lanceolate, base cuneate, apex acute, margins dentate, hispid, veins impressed and prominent beneath; petiole up to 3 mm. Flowers in axillary condensed bracteolate spikes up to 1 cm long, cylindrical; peduncle 15–30 mm, elongating in fruit; bracts 5–7 mm, ovate-lanceolate, acute, with prominently impressed nerves, densely white pubescent. Calyx membranous, 3.5–4 mm, pubescent. Corolla pink to blue-purple, ± 2-lipped, tubular, unequally 5-lobed above; tube ± 3 mm, slightly dilated above, pubescent. Stamens 4, included. Fruit a fleshy drupe, ± 3 mm, black when ripe, enclosed by the persistent calyx.

Flowering and fruiting: March to April.

Distribution and habitat: Northern Oman, on the Hajar mountains, amongst rocks and in rock crevices, and around cultivated areas, with *Sageretia* and *Sideroxylon*; not common, but usually not seen as it is usually grazed to the ground. *Altitude*: 1800–2500 m. Distributed in Sudan, Ethiopia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 662.

Notes: The leaves and roots have been used for treating abdominal colic.

77. **Avicenniaceae**

Cronquist (1981; cited in bibliography, Fl. Oman Vol. 1) includes *Avicennia* in Verbenaceae, but more recently it has been placed in the mono-generic family Avicenniaceae by several taxonomists (followed here). However, recent phylogenetic studies have suggested that *Avicennia* is derived from within Acanthaceae, and is included in that family in the APG III System.

Avicennia L.

A single genus distributed in coastal areas from Tropical Africa to Egypt and South Africa, the Arabian Peninsula, Indian Ocean Is., and tropical Asia to Australasia and SW Pacific; also Florida and Louisiana to Galapagos Is., Ecuador and Brazil.

The name *Avicennia* honours the Persian physician Abu Ali Sina or commonly Ibn Sina (Latinized Avicenna).

Avicennia marina (Forssk.) Vierh., Denkschr. Kais. Akad. Wiss., Wien, Math. Nat. Kl. 71: 435 (1907).

Basionym: *Sceura marina* Forssk. (1775). Type: Yemen, Al Luhayyah, *Forsskål* 317 and *Forsskål* s.n, (syntypes BM, C).

Vernacular name: qurm.

Description: Evergreen tree or shrub, up to 6 m with pneumatophores. Bark brown, smooth. Leaves opposite, 2–10 × 2–7 cm, lanceolate to elliptic to ovate, glabrous above, grey-green, white-woolly beneath, apex acute, base cuneate, margins entire. Flowers in dense terminal and axillary clusters; bracts and bracteoles ovate to suborbicular. Calyx 5-lobed, 3–4 mm, tomentose, ciliate. Corolla 4-lobed, yellow; tube 2–3 mm, glabrous; lobes 2–3 mm, ovate, pubescent. Stamens 4, all fertile. Fruit a capsule, ± 3 cm long, rounded to ovoid, somewhat compressed, fleshy, green, opening by 2(–4) valves.

Flowering and fruiting: May to August.

Distribution and habitat: Throughout coastal Oman, in patches, on muddy flats and shallow sea inlets. *Altitude*: 0–2 m. Distributed along the coast in Djibouti, Eritrea, Somalia, Sudan, Kenya, Tanzania and southern Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 663.

Notes: Although the mangroves are not uncommon in Oman, their distribution is very restricted. In Dhofar, they occur around sea inlets called *khawrs*. There, the mangroves are degrading and not showing much regeneration. The mangroves are used as fodder for livestock where the branches are cut and leaves fed to the camels. The area around the *khawrs* is badly trampled killing and uprooting the young seedlings.This, coupled with the increasing salinity of the *khawrs* due to the development of roads and hotels nearby, the mangroves are badly affected and very little regeneration is apparent at these locations. Recently a few of the *khawrs* have been fenced to keep away the camels. In northern Oman, a public park has been developed close to the mangroves, with an artificial lake filled with water from

an aquifer. A road has been built close to the mangroves, which has increased the salinity of a part of the area and is severely affecting the mangroves at this site. Strict measures are necessary for the conservation of mangroves in both northern and southern Oman. On the Regional Red List this species is assessed as Vulnerable [VU A2(a)].

78. **Lamiaceae**

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The family contains 236 genera and around 7000 species, and is almost cosmopolitan, but is absent from high altitudes of coldest regions. Recently the Lamiaceae is expanded with several genera of the Verbenaceae (including many large trees and shrubs) and Chloanthaceae (including several genera of shrubs endemic to Australia) included in the Lamiaceae. *Premna* and *Vitex* (found in Oman), formerly included in the Verbenaceae have recently been transferred to the Lamiaceae (treated as such in this flora).

Key to the genera of Lamiaceae in Oman

1. Leaves pinnatisect or at least some leaves deeply lobed ..... 10. **Lavandula**
   Leaves entire or with crenate or dentate margins, never pinnatisect or deeply lobed ... 2
2. Calyx with a broad spreading scarious lower lip, upper lip much smaller . 2. **Rydingia**
   Calyx without a broad spreading scarious lower lip 3
3. Corolla with 4 ± equal lobes ..... 5. **Mentha**
   Corolla distinctly 2-lipped 4
4. Calyx 10-lobed with 10 teeth (8–10 in *L. dhofarense*); corolla white, villous .. 3. **Leucas**
   Calyx with 5 teeth; corolla blue, pinkish or violet or white 5
5. Stamens included in the corolla tube ..... 13. **Endostemon**
   Stamens exserted from the corolla tube 6
6. Leaf margins distinctly crenate to serrate 7
   Leaf margins entire or obscurely dentate or inrolled 9

7. Staminal filaments connate below; corolla purple or blue, lower lip > twice long as long as the upper lip ..... 14. **Plectranthus**
Staminal filaments free; corolla white or violet, lower lip < twice long as long as the upper lip 8
8. Calyx throat glabrous inside; corolla white, lower lip enclosing the young stamens ... . 12. **Orthosiphon**
Calyx throat villous inside; corolla pink or pinkish to purplish white, not enclosing the young stamens ..... 11. **Ocimum**
9. Stamens 2 10
Stamens 4 11
10. Calyx 2-lipped, glandular with capitate glandular and eglandular hairs; upper lip with 3 subequal teeth, lower lip with 2 acuminate lobes; staminal connectives clearly separating the anther thecae ..... 4. **Salvia**
Calyx scarcely 2-lipped with short and long spreading eglandular spreading hairs and oil globules; staminal connectives absent ..... 8. **Ziziphora**
11. Corolla split dorsally to base appearing 1-lipped; lip 5-lobed ..... 1. **Teucrium**
Corolla not split to appear 1-lipped; upper lip entire or 2-lobed, lower lip 3-lobed ... 12
12. Bracts linear-oblong, with marginal awns 2–4 mm long ..... 9. **Lallemantia**
Bracts entire, without marginal awns 13
13. Pubescence densely woolly with branched hairs ..... 10. ***Lavandula hasikensis***
Pubescence without branched hairs 14
14. Ovary shallowly or deeply 4-lobed 15
Ovary entire; fruit a drupe with 1–2 pyrenes 16
15. Leaves broadly ovate to orbicular, white-pubescent when young, glabrescent; stamens not exserted ..... 6. **Zataria**
Leaves ovate-lanceolate, upper surface mostly papillose to hairy, lower surface hairy at least on the veins; stamens exserted ..... 7. **Micromeria**
16. Leaves simple ..... 15. **Premna**
Leaves digitately compound ..... 16. **Vitex**

1. **Teucrium** L.

About 200 species, mainly temperate regions, concentrated in the Mediterranean and central Europe, but also found in the New World, Australia and South Africa.

1. Leaves usually erect and adpressed to stem, sessile, linear-oblong (4–9 × 1–3 mm), margins often revolute, with 2–4 dentations at the apex, white-pubescent with long eglandular and shorter glandular hairs and sessile glands; flowers congested in terminal capitate heads up to 2 cm long ..... 1. **T. mascatense**
Leaves linear-oblong to obovate to suborbicular to oblong-ovate, usually wider than 3 mm, with entire margins or margins rarely revolute; indumentum of densely to sparsely white villous or tomentose hairs with ± sessile glands 2

2. Flowers congested in terminal, usually capitate heads up to 6 cm; upper bracts linear-elliptic, ± equalling calyx, appearing tufted at apex of young inflorescence .... 2. **T. stocksianum**

Flowers congested in terminal oblong heads up to 10 cm; upper bracts often 3-lobed at apex, slightly exceeding the calyx 3

3. Calyx 6–7 mm long, campanulate to somewhat tubular; corolla purple to pink, 8–12 mm ..... 3. **T. nummularifolia**

Calyx 5–7 mm long, ovate, slightly narrow at mouth, inflated on ventral side near base; corolla purple to pink with yellow markings in throat, 7–9 mm .... 4. **T. yemense**

1. ***Teucrium mascatense*** Boiss., Diagn., ser.1, 5: 44 (1844).
Type: Oman, Mascate [Muscat], in monte Chebek regni [Jebel Akhdar range], *Aucher Eloy* 5172 (holotype G; isotypes BM, K).
Vernacular name: ja'ada.

Description: Tufted perennial herb with a woody base, 10–25 cm. Stems branched from base, erect or ascending, densely white tomentose to sometimes lanate, with + small glandular hairs, the older stems glabrescent. Leaves grey-green, aromatic, usually erect and adpressed to stem, sessile, 4–9 × 1–3 mm, linear-oblong, base cuneate, apex obtuse, margins often revolute, with 2–4 dentations at the apex, white-pubescent with long eglandular and shorter glandular hairs and sessile glands. Flowers congested in terminal capitate heads up to 2 cm long; pedicels + 1 mm; bracts like leaves, slightly exceeding the calyx. Calyx 5–8 mm long, obconical to tubular-campanulate, densely glandular with some eglandular long hairs on margins of lobes; lobes 5, ± equal, + 2 mm, triangular, acute. Corolla purple to pale-violet or pink to white with darker pink veins, 9–12 mm, split dorsally to base appearing 1-lipped; tube ± 4 mm; lip oblong-triangular with a cucullate central lobe and small oblong, 2 lateral and a posterior lobe, pubescent on the outside. Stamens exserted, curved; filaments pilose near base. Nutlets ± 2 mm, rugulose.

Flowering and fruiting: February to May, also flowering in September and October.

Distribution and habitat: Northern Oman, on the western Hajar mountains on the Jebel Akhdar range, and in Musandam, on rocky hill slopes and open rocky ground. *Altitude*: 1000–2800 m. Endemic to northern Oman.

Distribution map & Illustration: 664.

Notes: The leaves and flower heads have been used in traditional medicine. Not palatable to livestock.

2. ***Teucrium stocksianum*** Boiss., Diagn, ser. 2, 4: 58 (1859).
Type: Pakistan, Baluchistan, Hala, *Stocks* (holotype G; isotypes BM, K).

subsp. ***stocksianum***
Vernacular name: ja'ada.

Description: Perennial herb often woody at base, up to 30 cm. Stems branched from base, erect or ascending, densely white tomentose. Leaves grey-green, aromatic, sessile to shortly petiolate, 4–15 × 2–7(–11) mm, linear-oblong to broadly obovate, base cuneate, apex obtuse, margins flat or revolute, entire or dentate at the apex, white-pubescent with eglandular hairs and sessile glands, especially on the lower surface, aromatic when crushed. Flowers congested in terminal usually capitate heads up to 6 cm; bracts leaf-like, linear-elliptic, ± equalling calyx, appearing tufted at apex of young inflorescence. Calyx 6–7 mm long, obliquely campanulate, pubescent with longer hairs on the ribs, with small glandular hairs and sessile glands; lobes 5, ± equal, ± 2 mm, triangular, acute. Corolla white with pink veins, or pinkish or violet, 11–14 mm, split dorsally to base appearing 1-lipped; tube 5–6 mm, pilose with small glandular hairs on the outside; lip oblong-triangular with a cucullate central lobe and small oblong, 2 lateral and a posterior lobe. Stamens exserted, curved; filaments pilose near base. Nutlets ± 2 mm, rugulose.

Flowering and fruiting: February to May.

Distribution and habitat: Northern Oman, on the western Hajar mountains on the Jebel Akhdar range, and in Musandam, on rocky hill slopes and plateau, in small sandy depressions amongst stones and rocks; fairly widespread. *Altitude*: (50–)300–2800 m. Distributed in SW Pakistan (Baluchistan), Afghanistan and Iran. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

Distribution map & Illustration: 665.

subsp. ***stenophyllum*** R.A.King, Notes Roy. Bot. Gard. Edinb. 45(1): 21–42. (1988).
Type: Oman, Dibab, SE of Quryat, *Gallagher* 7499/8, (holotype E; isotype ON).
Recognised on its linear-oblong leaves that are 4 + as long as broad, tomentose or with short hairs, with entire or margins with 1–3 dentations near apex, usually strongly revolute.

Flowering and fruiting: February to April/May.

Distribution and habitat: Northern Oman, on the western and eastern Hajar mountains, and in Musandam, on rocky hill slopes and plateau, sandy depressions amongst stones and rocks; widespread. *Altitude*: 30–2000 m. Endemic to northern Oman, possibly also occurring on the mountains in the UAE.

Distribution map & Illustration: 666.

Notes: Sometimes difficult to tell apart from *T. mascatense*, but *T. mascatense* is confined to the mountains and this taxon is also found at lower altitudes.

3. ***Teucrium nummularifolium*** Baker, Kew Bull. 1895: 185 (1895).
Type: Oman, Dhofar mountains, Wadi Gerzid, 1895, *J.T. Bent* 169 (holotype K).
Synonym: *T. paulayanum* Schwartz (1939). Type: Yemen, Wadi Dhaurûten, Ras Fartak, *Paulay* s.n. (B ?destroyed).
Vernacular name: ja'ada.

Description: Perennial herb with a woody base, up to 30 cm. Stems branched from base, decumbent or ascending, densely white tomentose to villous. Leaves grey-green, sessile or with petiole up to 5 mm, 6–20(–27) × 5–20 mm, obovate to suborbicular to oblong-ovate, base cuneate, apex obtuse, margins entire or sometimes revolute or with 4–5 pairs of dentations at the apex, densely to sparsely white villous or tomentose with sessile glands, aromatic when crushed. Flowers congested in terminal oblong heads up to 10 cm, softly villous, upper bracts 5–12 mm, linear-oblong to oblong, often 3-lobed, slightly exceeding the calyx; pedicels 1 mm. Calyx 6–7 mm long, campanulate to somewhat tubular, densely villous with sessile glands; teeth ± equal, 2 mm, triangular, acute, densely ciliate. Corolla purple to pink, 8–12 mm; tube ± 4 mm; lip oblong-triangular with a cucullate central lobe and small oblong, 2 lateral and a posterior lobe, pilose on the outside with small capitate glandular hairs. Stamens exserted, curved; filaments densely hairy near base. Nutlets ± 2 mm, rugulose.

Flowering and fruiting: February to May; October to November.

Distribution: Southern Oman, Dhofar, in various habitats, from the wet wooded escarpments with *Anogeissus* to the summit grasslands, and in the *Euphorbia balsamifera* zone; also found in the drier rocky slopes with *Acacia* and *Commiphora*, gravel plains and in sand and silt on coastal cliffs. *Altitude*: 50–1100 m. A regional endemic also distributed in SE Yemen (Hadramaut).

Distribution map & Illustration: 667.

Notes: This is a common species found in Dhofar with variations in the density of its indumentum and leaf shape. It has not been included by Wood (Fl. Yemen 1997), but I have seen a few sheets from Yemen (including type of *T. paulayanum*) that are referable to this species. Vegetative variations are found both in this and *T. yemense* but both are distinct and recognized as distinct taxa.

Crushed leaves mixed with oil have been used in traditional medicine for babies with fever.

4. ***Teucrium yemense*** Deflers, Voyage au Yemen: 190 (1889).
Type: Yemen, Wadi Schidja, near Menakha, *Deflers* 443 (lectotype P).

Description: Perennial herb with a woody base, 5–15 cm. Stems branched from base, ascending, densely white tomentose with glandular hairs and ± sessile glands. Leaves grey-green, ± sessile, 5–16 × 2–5 mm, oblong to obovate, base cuneate, apex obtuse, margins flat or revolute, with 3–4 pairs of dentations at the apex, densely white-pubescent with sessile glands, aromatic when crushed. Flowers congested in terminal capitate to oblong heads up to 6 cm; bracts linear-spatulate, exceeding the calyx and appearing tufted at apex of inflorescence; pedicels 0.5 mm, glandular. Calyx 5–7 mm, ovate, slightly narrow at mouth, inflated on ventral side near base, pubescent with longer hairs on the ribs and sessile glands; teeth ± 2 mm, triangular, acute, densely ciliate. Corolla purple to pink with yellow markings in throat, 7–9 mm, tube ± 4 mm, lip oblong-triangular with a cucullate central lobe and small oblong, 2 lateral and a posterior lobe, pubescent on the outside with small

capitate glandular hairs. Stamens exserted, curved; filaments pilose near base. Nutlets ± 1.6 mm, rugulose.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar on coastal hills and open rocky slopes with *Pulicaria*, *Cinidia somalensis* etc. *Altitude*: ± 1500 m. Restricted to southwest Arabian Peninsula, elsewhere found in Saudi Arabia and Yemen.

Distribution map & Illustration: 668.

Notes: Not common in Oman and known from a couple of specimens (*Miller & Nyberg* 9281 from Sarfait, Oman-Yemen border).

2. **Rydingia** Scheen & V.A.Albert

Four species distributed in Oman, Iran, Afghanistan, and Pakistan.

Rydingia persica (Burm. f.) Scheen & V.A.Albert, Syst. & Geogr. Pl. 77(2): 235 (2007).
Basionym: *Moluccella persica* Burm.f. (1768). *Synonyms*: *Otostegia microphylla* Boiss. (1844); *O. kotschyi* Boiss. (1846); *O. persica* (Burm.f.) Boiss. (1846).
Vernacular name: qisummat al wa'al (Eastern Hajar, Jebel Qahwan).

Description: Spiny shrub up to 1.5 m. Stems branched, densely eglandular-pubescent. Leaves 10–12 × 10 mm, suborbicular to broadly obovate, base cuneate, apex obtuse, margins crenate to dentate with small spinules ± 1 mm long, densely pubescent with eglandular hairs and sessile glands; petiole ± 10 mm. Spines up to 20 mm present in the axils of leaves. Verticillasters few-flowered, distantly placed; bracts spiny, spreading. Calyx 10-ribbed, densely pilose, tube ± 8 mm, lower lip broadly ovate, spreading, irregularly lobed and toothed, scarious, straw-coloured; upper lip small. Corolla white, ± 20 mm, 2-lipped; tube about the same length as the calyx tube; upper lip 10–11 mm, densely villous. Nutlets obovoid, with oil globules, often only one maturing (?).

Flowering and fruiting: October to November.

Distribution and habitat: Northern Oman, in the eastern Hajar mountains, in a small gorge with *Astragalus fasciculifolius*, *Prunus* and *Ziziphus*. *Altitude*: ± 1800 m. Distributed in southern Iran and SW Pakistan.

Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 669.

Notes: So far recorded from a couple of localities in the eastern Hajar mountains. Not threatened at present due to its remote location, but may qualify as Vulnerable or Endangered on the Regional Red List if the location is made accessible by a good road which is likely to happen in the near future. It is assessed here as Near Threatened [NT] on the Regional Red List. Its presence in the northern mountains of Oman reflect the close floristic links between Iran, SW Pakistan (Baluchistan) and Oman.

3. **Leucas** R.Br.

A genus of about 100 species, distributed from tropical to southern Africa, Arabian Peninsula, Iran to southern China, Taiwan, Japan and SE Asia.

1. Leaves broadly ovate to suborbicular; calyx inflated ..... 2. **L. inflata**
   Leaves ovate to ovate-lanceolate; calyx tubular, not inflated 2
2. Stems with eglandular hairs ..... 1. **L. urticifolia**
   Stems with glandular hairs ..... 3. **L. dhofarensis**

1. ***Leucas urticifolia*** (Vahl) Sm. in A.Rees, Cycl. 20 [without pagination] (1812) [generic position suggested by Robert Brown, Prodr. Fl. Nov. Holl.: 564 (1810) but new combination not properly made.

Synonym: *Phlomis urticifolia* Vahl (1794). Type: India, *Köenig* s.n. & Yemen, *Forsskal* s.n. (syntypes C).

Vernacular name: gemrez (Jibbali).

Description: Annual or perennial herb with a woody base. Stems erect, simple or branched, up to 50 cm, eglandular-pubescent with short retrorse hairs. Leaves petiolate, up to 2–4 × 0.6–2.5 cm, ovate to ovate-lanceolate, base ± cuneate, apex acute to obtuse, margins crenate-serrate, pubescent, adpressed pubescent, eglandular above, scattered sessile glands on the undersurface; petiole 6–20 mm. Inflorescence of 2–6 verticils, usually laxly spaced, becoming more congested near apex; flowers many in each cyme, bracteoles 5–8 mm, linear to narrowly oblanceolate, pubescent with sometimes bristly hairs, pedicels ± 1 mm long. Calyx 7–8 mm, tubular, 10-nerved, pubescent, hairs longer and dense along the vein ridges; throat asymmetric; lobes 10, subequal; teeth narrow triangular with short spinescent tips. Corolla white, 6–10 mm; tube 4–6 mm; upper lip entire forming a hood over style and stamens, densely pubescent, white-ciliate along the margin; lower lip 3-lobed, the central longer than the two laterals. Stamens 4, filaments with eglandular hairs about halfway up. Nutlets 2–2.4 mm, glandular at the apex.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, on rocky coastal areas, and headlands; common. *Altitude*: 10–850 m. Distributed from Sudan to Kenya, Mauritiana, Arabian Peninsula to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen, also found on Socotra.

Distribution map & Illustration: 670.

Notes: Two other varieties are found in Somalia, Ethiopia and eastern Africa. All Oman plants are referable to subsp. *urticifolia*.

Wild collected seed of this species is held at the Seed Bank at the Millennium Seed Bank, Royal Botanic Gardens, Kew, U.K.

2. ***Leucas inflata*** Benth., Labiat. Gen. Spec.: 744 (1835).

Basionym: *Physoleucas inflata* (Benth.) Jaub. & Spach ex Briq. (1896).

Vernacular name: qotnya (A).

Description: Woody based annual or perennial herb, grey-green. Stems erect, simple or branched, up to 50 cm, grooved, eglandular-pubescent. Leaves yellowish-green, shortly petiolate, up to 20 × 25 mm, ovate to suborbicular, base truncate, apex rounded to obtuse, margins crenate at the apex, pubescent; petiole 5–10 mm. Inflorescence of many verticils, lax below congested above on the stems, flowers many congested in each cyme; bracteoles 5–8 mm, ovate-suborbicular, densely white-hairy; pedicels ± 1 mm long. Calyx 7–8 mm, somewhat inflated, 10-nerved; lobes 8–10; teeth ±1 mm, narrow triangular, white-pubescent with long hairs. Corolla white, 10–11 mm; tube ± 5 mm; upper lip forming a hood, emarginate, densely ciliate on margins; lower lip 3-lobed, the central longer than the two laterals. Stamens with eglandular filaments. Nutlets glandular at the apex.

Flowering and fruiting: March; September to October.

Distribution and habitat: Northern Oman, Musandam and Dhofar; on rocky hillsides, gulleys, gravely wadi beds and banks, amongst rocks and on coastal cliffs. *Altitude*: 20–1200 m; common. Distributed in Egypt, Sudan, Ethiopia, Somalia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 671.

3. ***Leucas dhofarensis*** Hedge & O.Sebald, Notes Royal Bot. Gard. Edinb. 40(1): 63 (1982). Type: Dhofar, Jebel Qara, *Vesey-Fitzgerald* 12428/3 (holotype BM; isotype STU).
Vernacular names: heryen, ekulen (Jibbali).

Description: Woody based annual or perennial herb. Stems erect, simple or branched, up to 60 cm, grooved, glandular-hairy. Leaves petiolate, 20–70 × 18–45 mm, broadly ovate, base cuneate, apex obtuse, margins crenate, pubescent with eglandular or glandular hairs. Flowers in dense verticils at the nodes, in leaf axils; bracts 7–8 mm, linear. Calyx 7–8 mm, 10-ribbed, the anterior expanded; teeth 8–10, the anterior expanded. Corolla white, the upper lip curving upwards, emarginate, densely hairy on the margins; lower lip 3-lobed. Stamens with eglandular filaments. Nutlets brown, ± 2 mm, glandular.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, in wadis, hill slopes, by roadsides, with *Commiphora*, *Euphorbia balsamifera*, *Anogeissus*. *Altitude*: 30–110 m. A regional endemic, found in Oman (Dhofar) and Yemen (S); also found on Soqotra.

Distribution map & Illustration: 672.

4. **Salvia** L.

About 900 species widely distributed in the temperate and tropical regions.

Salvia spp. are not commonly cultivated in private homes in Oman, but I have seen *Salvia splendens*, a native of Brazil with bright red calyces and corollas cultivated in a few homes.

1. Leaves clustered basally, few or absent above; inflorescence a wide, branched panicle ..... 4. **S. macrosiphon**
   Leaves not clustered basally; inflorescence simple 2
2. Bracts broadly ovate to suborbicular ..... 5. **S. mirzayanii**
   Bracts ovate to elliptic 3
3. Leaves with sinuate-convolute margins, pinnatifid ..... 2. **S. santolinifolia**
   Leaves with entire to dentate or shallow to obscurely lobed margins 4
4. Pubescence of simple retrorse and long hairs 5
   Pubescence of simple and branched hairs 6
5. Leaf margins entire or with 2–3 shallow lobes, ± glabrous with short and long eglandular hairs and orange oil globules on both surfaces; calyx densely pubescent with long eglandular spreading hairs and shorter capitate glandular hairs, ciliate on margins ..... 3. **S. macilenta**
   Leaf margins dentate, white-pubescent with eglandular and sometimes capitate glandular hairs; calyx not densely pubescent ..... 1. **S. aegyptiaca**
6. Calyx 3.5–5 mm, densely pubescent with eglandular simple and branched hairs, interspersed with capitate glandular hairs and sessile glands ..... 6. **S. hillcoatiae**
   Calyx 6–7 mm, densely villous with long multicellular hairs interspersed with shorter glandular hairs ..... 7. **S.** sp. **A**

1. ***Salvia aegyptiaca*** L., Sp. Pl.: 23 (1753).
Vernacular names: ra'al, brayhoo.

Description: Low shrub or a perennial herb, up to 30 cm with twisted woody basal stems, aromatic. Stems quadrangular, much branched, erect to ascending, with retrorse eglandular hairs interspersed with few long hairs. Leaves opposite, grey-green, petiolate below shortly petiolate to sessile above, 5–30 × 2–10 mm, oblanceolate to elliptic, rugulose, base rounded, apex acute, margins dentate, veins depressed, white-pubescent with eglandular and sometimes capitate glandular hairs, petiole 3–7 mm. Verticils few flowered, distantly placed along the stems but usually in the upper part, bracts ± 5 mm, ovate, acuminate; pedicels 5–6 mm. Calyx often with brownish or purplish upper lip, greenish lower lip, 6–7(–9 mm in fruit), campanulate, 2-lipped, hairy and glandular with capitate glandular and eglandular hairs, ribs distinct on tube; upper lip 3 mm, with 3 subequal teeth, ± 1 mm, lower lip with 2 triangular acuminate lobes ± 4 mm. Corolla white or pale blue with purple mottling on lip, 2-lipped, 5–6 mm; upper lip ± straight, lower lip 3-lobed, longer than the upper with the central lobe larger than the laterals. Stamens 2, filaments short, but connective much extended, filament-like and separating the anther thecae; posterior theca always large and fertile; anterior theca smaller. Nutlets black, smooth, mucilaginous on wetting.

Flowering and fruiting: February to June; September to October.

Distribution and habitat: Throughout Oman, including Musandam, Masirah and Hallaniyat Islands, in wadis, gorges and slopes of mountains and foothills, amongst stones and rocks,

in clayey and silty soil; common. *Altitude*: 100–2000 m. Distributed from NW and N Africa, through the Arabian Peninsula to Iran, Afghanistan, Pakistan and India. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 673.

Notes: The seeds have been used in traditional medicine as a demulcent, for diarrhoea and as a relief for piles.

2. ***Salvia santolinifolia*** Boiss., Diagn. Pl. Or. Nov. Ser. 1, 5: 13 (1844).

Description: Low shrub, up to 30 cm, with twisted woody basal stems, aromatic. Stems quadrangular, much branched from the base, erect to ascending, with retrorse short eglandular interspersed with long eglandular hairs, glandular above and with ± oil globules. Leaves opposite, grey-green, ± sessile, 5–10 × 2–3 mm, oblong in outline with a sinuate-convolute margins, pinnatifid, base cuneate, apex obtuse, white-pubescent with eglandular and glandular hairs and yellow or orange oil globules on the undersurface. Verticils 1–2- flowered, distantly placed along the stems but usually in the upper part; bracts elliptic, acute; pedicels 1.5 mm, elongating and recurved in fruit. Calyx grey-green, 5–6 mm, campanulate, 2-lipped, densely pubescent with long eglandular spreading hairs and shorter capitate glandular hairs and sessile glands; upper lip of acuminate spinulose teeth. Corolla pink to lilac to pale violet with darker mottling on lip, 2-lipped, 5–6 mm; upper lip ± straight, lower lip 3-lobed, longer than the upper with the central lobe larger than the laterals. Stamens 2; filaments short; staminodes present. Nutlets black, smooth, ?mucilaginous on wetting.

Flowering and fruiting: March/April.

Distribution and habitat: Northern Oman, in the western Hajar mountains, in gravely wadi beds, amongst stones with *Pteropyrum*. *Altitude*: ± 800 m. Distributed in Iran, Afghanistan and Pakistan. Elsewhere in the Arabian Peninsula found in the UAE.

Distribution map & Illustration: 674.

Notes: Collected only once from northern Oman; not common but possibly very localised and over looked; also not common in the UAE, found only in the mountains of northern Emirates.

3. ***Salvia macilenta*** Boiss., Diagn. Pl. Or. Nov. ser. 1, 5: 13 (1844).
Type: Oman, ad radices regni Mascatensis, *Aucher-Eloy* 5210 (holotype G; isotypes K, W).
Vernacular name: bithman.

Description: Perennial herb or low shrub, up to 25 cm with woody basal stems. Stems quadrangular, much branched from the base, erect, ± glabrous or with adpressed very short eglandular hairs, many orange oil globules present throughout the length of the stems. Leaves very few and distantly placed on the stems, opposite, grey-green, ± sessile, 3–6 × 2–3 mm, oblanceolate, base cuneate, apex obtuse, margins entire or with 2–3 shallow lobes, ± glabrous with short and long eglandular hairs and orange oil globules on both sur-

faces. Verticils 1–2- flowered, distantly placed along the stems but usually in the upper part; bracts ovate, acute; pedicels 1.5–2 mm, elongating and recurved in fruit. Calyx grey-green, 3–4 mm, campanulate, 2-lipped, densely pubescent with long eglandular spreading hairs and shorter capitate glandular hairs and oil globules, ciliate on the teeth margins; upper lip with acuminate spinulose teeth. Corolla lilac to pale violet, 2-lipped, 5–6 mm; tube ± 4 mm, upper lip ± straight, lower lip 3-lobed, longer than the upper with the central lobe larger than the laterals. Stamens 2; filaments short; staminodes present. Nutlets black, smooth, ?mucilaginous on wetting.

Flowering and fruiting: February/March.

Distribution and habitat: Northern Oman, in the foothills of the western Hajar mountains, wadi beds and banks, rocky ground, crevices of rocks, with *Tephrosia*, *Moringa peregrina*, *Lavandula macra*. *Altitude*: 300–450 m. Distributed in Iran, Afghanistan and Pakistan. Elsewhere in the Arabian Peninsula found in the UAE.

Distribution map & Illustration: 675.

Notes: In facies the species looks similar to *S. santolinifolia*, but the two are distinct and can be easily separated by their leaf shape and general characters of the indumentum.

The plant [nutlets] have been used in traditional medicine to treat stomach ache, bloating and colic.

4. ***Salvia macrosiphon*** Boiss., Diagn. Pl. Orient. Nov. ser. 1, 5: 11 (1844).
Synonyms: *Salvia kotschyi* Boiss. (1846); *S. macrosiphon* Boiss. var. *kotschyi* (Boiss.) Boiss. (1879).

Description: Rosetted low shrub, up to 75 cm, with woody basal stems, aromatic with a lemony smell when crushed. Stems quadrangular, purple below, green above, branched from the base, erect, white eglandular pilose below, shortly glandular and with sessile oil globules above. Leaves opposite, mostly clustered basally, grey-green, 6–14 × 1.5–8 cm, elliptic to ovate-oblong, base cuneate, apex acute, margins entire to irregularly serrate, white-pubescent with eglandular hairs and oil globules on the undersurface, rugose on the upper surface; petioles up to 10 cm. Inflorescence a widely branched panicle, verticils 2–6-flowered, distantly placed along the stems, bracts broadly ovate; pedicels 2 mm, erect to spreading in fruit. Calyx grey-green, tubular, 14–17 mm, elongating slightly in fruit, 2-lipped, distinctly ribbed, pubescent with capitate glandular hairs and oil globules; teeth spinulose. Corolla white, 2-lipped, 20–25 mm; upper lip ± falcate, lower lip 3-lobed, shorter than the upper lip. Nutlets brown, shiny, ?mucilaginous on wetting.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, on the eastern Hajar mountains, and Musandam, on small ledges on rocky scarps, and amongst stones on rocky slopes. *Altitude*: 50–1400 m. Distributed in Iraq, Iran, Caucasus, Afghanistan and Pakistan. Elsewhere in the Arabian Peninsula found in the UAE.

Distribution map & Illustration: 676.

Notes: A widespread and polymorphic species in a range of habitats and with variations in indumentum characters, leaf shape, and size of calyx and corolla throughout its range of distribution. It is very similar to *S. spinosa* L. distributed in Turkey, Egypt, Palestine, Syria through to Iraq, Iran Afghanistan and Pakistan., but can be distinguished by its smaller stature, shorter, narrower calyx, and on the whole lacking the pilose indumentum of *S. spinosa*. Rechinger in Flora Iranica (p. 445) states that variations in *S. macrosiphon* are probably due to hybridization with other species such as *S. spinosa* and *S. moorcroftiana* Wall. ex Benth., a related species. There is not enough material from Oman to establish whether *S. macrosiphon* is conspecific with *S. spinosa*, but with more material, also from the UAE and Saudi Arabia the two taxa may be conspecific. This and the next species are in a group of similar species (*S. spinosa*, *S. reuterana* Boiss. (endemic to Iran)) distributed mainly in Iraq and Iran that show few morphological differences between them. A thorough study of the Iranian and Iraqi material, possibly with molecular data is necessary to delimit the species in this group.

In Oman, *S. macrosiphon* is recorded from Musandam and the eastern Hajar (Jebel Aswad) where it is reported to be abundant; apparently localised but not rare where found.

5. ***Salvia mirzayanii*** Rech.f. & Esfandiari, Oesterr. Bot. Zeit. 99: 53 (1952).

Description: Low shrub, up to 35 cm, with woody basal stems, aromatic. Stems quadrangular, ± branched from the base, erect, white eglandular pilose below, densely glandular above with capitate glandular hairs and oil globules. Leaves opposite along the stem, grey-green, 1.8–4.5 × 0.3–1 cm, linear to linear-lanceolate, base cuneate, apex acute, margins entire, eglandular white-lanate, rugose on the upper surface; petioles up to 4 mm. Inflorescence simple panicle, verticils 4–6-flowered; bracts 10–12 mm, broadly ovate to suborbicular; pedicels 1–2 mm, erect to spreading in fruit. Calyx grey-green, tubular, 12–14 mm, elongating to 14–15 mm in fruit, 2-lipped, distinctly ribbed, glandular pilose; upper lip with 3 acuminate teeth. Corolla white to violet, 2-lipped, 20–25 mm; tube ± erect; upper lip ± falcate, lower lip 3-lobed. Nutlets not seen.

Flowering and fruiting: March/April.

Distribution and habitat: Northern Oman, on the Musandam mountains, on the plateau summit of Jebel Harim; localised and not very common. *Altitude*: 1450–1850 m. Distributed in Iran. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 677.

Notes: The species is reported to be uncommon possibly due to over grazing in the whole area. On the National Red List is assessed here as VU B2 (b), based on its narrow distribution in Oman and continued decline of its habitat.

6. ***Salvia hillcoatiae*** Hedge & Sebald, Notes R.B.G. Edinb. 40(1): 69 (1982).
Type: Oman, Dhofar, Wadi Shibum, Ramaida, 11 Feb 1947, *Thesiger* s.n. (holotype BM).

Description: Low shrub, up to 15 cm, with a woody base; whole plant densely white-velutinous with dendroidal hairs. Stems quadrangular, branched from the base, erect to ascending, with branched hairs and sessile glands. Leaves few on stems, opposite, grey-green, ± sessile, 6–8 × 3–6 mm, thick and rugose, ovate to ovate-elliptic, base cuneate, apex obtuse, margins entire or obscurely crenate, pubescent with branched hairs and sessile glands, nerves indistinct. Verticils 1–2-flowered, few on the stems; bracts linear to ovate; pedicels 2 mm, ± erect in fruit. Calyx grey-green, 3.5–5 mm, campanulate, 2-lipped, densely pubescent with eglandular simple and branched hairs, interspersed with capitate glandular hairs and sessile glands; upper lip of mucronate teeth. Corolla pale blue, 2-lipped, 5–8 mm, upper lip ± straight.

Flowering and fruiting: October.

Distribution and habitat: Southern Oman, Dhofar, on the dry northern foothills of Jebal Semhan and the north facing slopes of Jebal Qamar. *Altitude*: ± 300 m. Endemic.

Distribution map & Illustration: 678.

Notes: Known from two specimens collected in 1943 and 1947, and as far as I know not collected since. The population of this species and several other species on Jebal Semhan is under threat due to rapid development and construction of new roads there. On the National Red List is assessed here as VU B2 (b), based on its narrow distribution in Oman and continued decline of its habitat.

7. *Salvia* sp. *A*

Description: Low shrub, 15–30 cm; stems erect, branched from the base, erect to ascending, arising from a woody base; whole plant densely white-velutinous with dendroidal and simple hairs; stems with dendroidal hairs and sessile glands. Leaves opposite, grey-green, erect, thick and somewhat rugose, ± sessile, 5–12 × 3–8 mm, ovate-elliptic to obovate, base cuneate, apex obtuse, margins ± entire to crenate, often inrolled, densely pubescent with dendroidal hairs and sessile glands; nerves prominent on the lower surface. Inflorescence of terminal cylindrical spikes, 15–20 mm, with up to 10 flowers; bracts dark purplish-green, 6–8 mm, narrowly elliptic, villous with long multicellular hairs interspersed with shorter glandular hairs; hairs 1–2.5 mm. Calyx purplish-green, 6–7 mm, campanulate, 5-lobed, densely villous with long multicellular hairs interspersed with shorter glandular hairs; lobes narrowly ovate, acuminate; lower 2 lobes lobed to half of calyx length, upper 3 lobes lobed to ⅓ the calyx length. Corolla purplish?, 2-lipped, 10–11 mm; tube 7–8 mm, curved; upper lip 2-lobed, lobes oblong, ± 3 mm, with a few hairs on the margin near the base; lower lip 3-lobed, lobes 1.5 mm, rounded. Stamens 2 with connective 3 mm long, upper anther theca 1 mm, lower 0.5 mm; staminodes 2. Style ± 11 mm, curved, shortly bi-lobed at the apex. Nutlets 4, brown, 1 mm, oblong.

Flowering and fruiting: November–December.

Distribution and habitat: Southern Oman, Dhofar, on the summit plateau of Jebal Semhan, on flat and rocky limestone areas. *Altitude*: 1300–1400 m. Endemic.

Distribution map & Illustration: 679.

Notes: Known from one or two specimens, localized but apparently not uncommon (Dhofar, Jebal Semhan, summit, 17°08' N 54°44' E, 1300–1400 m, 6 Dec. 2002, *Kilian & Frankenberg* NK 9275 (B)).

The small population of this species, and several other species on Jebel Semhan are under some threat due to easy accessibility of this area from the construction of new roads; this collection, for example, is about 1 km east of a limestone quarry. On the National Red List is assessed here as VU B2 (b), based on its narrow distribution in Oman and continued decline of its habitat.

5. **Mentha** L.

About 20 species distributed through Europe, Asia and Africa to southern Africa; Australasia; one species in New Zealand and North America.

Mentha longifolia (L.) L., Fl. Monspel.: 19 (1756).

Synonym: *Mentha spicata* L. var. *longifolia* L. (1763); *M. sylvestris* L. (1763).

Vernacular names: na'ana, ghagha.

Description: Perennial herb up to 50 m tall, with spreading rhizomes, aromatic. Stems erect, branched, quadrangular, white- or grey-villous. Leaves sessile or with short petioles, 4–11 × 1–4 cm, lanceolate or oblanceolate or oblong-elliptic, base truncate or rounded, apex acute, margins irregularly serrate, smooth or slightly rugose especially near base, green, ± glabrous above, villous beneath, with scattered sessile glands, veins conspicuous beneath; petiole 0–1.5 mm. Inflorescences of terminal branched spikes, verticils congested; bracteoles narrowly linear-elliptic. Flowers bisexual and female, pedicellate. Calyx 2–3 mm, campanulate, pubescent and with sessile glands; lobes ± 1 mm, subequal, subulate, acute. Corolla pale purple or white, 3–4 mm, 4-lobed, lobes spreading, subequal; upper lobe shallowly 2-lobed; corolla tube ± cylindrical, usually included within calyx. Stamens exserted, or included in functionally female plants. Nutlets dark brown, sparsely hairy in upper half.

Flowering and fruiting: March to April; September.

Distribution and habitat: Northern Oman, on the western Hajar mountains in the Jebel Akhdar range, at edges of cultivated land. Widespread through Europe eastwards to India and China. Cultivated and often found as an escape in the Arabian Peninsula.

Distribution map & Illustration: 680.

Notes: Mint (Arabic: na'na') is cultivated in several homes throughout Oman as a potherb used to flavour tea, the leaves are used for treating coughs and difficult breathing, stomach problems, chills and fevers.

6. **Zataria** Boiss.

Monotypic; distributed in Iran, Afghanistan and Pakistan.

Zataria multiflora Boiss., Diagn. Pl. Or. Nov. ser., 1, 5: 18 (1844).

Description: Low shrub, up to 45 cm, with leafless woody basal stems, much branched, young stems erect, densely white eglandular pilose, aromatic. Leaves opposite, grey-green, 5–10 × 5–10 mm, broadly ovate to orbicular, base rounded to cuneate, apex obtuse, margins entire, white-pubescent when young, glabrescent, gland dotted on both surfaces. Inflorescence of congested verticils, 8–10-flowered; bracts narrow oblong. Flowers often male-sterile; pedicels 1–2 mm. Calyx grey-green, tubular, ± 2 mm, teeth ± equal, densely eglandular pilose, hairs spreading, with many red oil globules. Corolla white, 2-lipped, 3 mm, scarcely exceeding the calyx, pilose with oil globules externally; upper lip 2-lobed, lower lip 3-lobed. Stamens 4, not exserted. Nutlets ovoid, smooth, only one developing.

Flowering and fruiting: April to June.

Distribution and habitat: Northern Oman, in the western Hajar mountains, on rocky and stony slopes, shallow gulleys, amongst rocks and stones. *Altitude*: 1900–2500 m. Distributed in Iran, Afghanistan, Pakistan (Baluchistan, Chitral). Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 681.

Notes: Known by the local people as za'ater [Arabic for thyme], and used in traditional medicine for stomach problems and colic.

7. **Micromeria** Benth.

A genus of about 50 species, distributed in the Mediterranean region, Macaronesia, North Africa, West Asia to China, Myanmar and India; one species in tropical Africa.

Micromeria imbricata (Forssk.) C.Chr., Dansk Bot. Ark. 4 (3): 21 (1922).

Synonyms: *Thymus imbricatus* Forssk., Fl. Aegypt.-Arab.: 108 (1775). Type: Yemen, Kurma, *Forsskål* s.n. (holotype C); *Satureja imbricata* (Forssk.) Briq. (1896); *Micromeria biflora* sensu auct. non (D.Don) Benth. (1834).

Description: Annual or perennial herb with a short woody base, aromatic. Stems up to 13 cm, erect to ascending, branching from the base, pubescent with short and long, retrorse or spreading eglandular hairs. Leaves opposite, 3–9 × 1.5–3 mm, ovate-lanceolate to elliptic, base cuneate, apex acute to obtuse, margins entire with thickened edges, upper surface mostly papillose to hairy, lower surface hairy at least on the veins, glands sessile. Flowers in 1–few-flowered verticils; bracts as leaves but smaller; bracteoles linear; pedicels ± 3 mm. Calyx 5-lobed, slightly 2-lipped, 3–3.5 mm, tubular; tube (11–)13(–15)-veined, ± hairy on veins and inside near the mouth, teeth acuminate, spreading. Corolla violet, purple or sometimes white, 3–11 mm; tube 2–5 mm, dilating above, upper lip emarginate; lower lip 3-lobed with central lobe ± emarginate, hairy on the outside. Stamens 4. Nutlets ovoid, glabrous, with a ± distinct areole at the scar, mucilaginous when wet.

Flowering and fruiting: April to May.

Distribution and habitat: Northern Oman, on the Hajar mountains, on stony and rocky slopes, shallow gulleys, amongst rocks; fairly common. *Altitude*: 700–2000 m. Distributed from West Africa eastwards to Egypt and south to southern Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 682.

Notes: A widespread and a very variable species, treated in some detail by O. Ryding in Bot. J. Linn. Soc. 155: 427–446 (2007). Ryding includes the Asiatic *Micromeria biflora* (Buch.-Ham. ex D.Don) Benth. in *M. imbricata* var. *imbricata*, but states that because of the similarities and differences with African material and based on the results from molecular analysis it should probably be treated as a separate variety under *M. imbricata*, and that it should await a revision of the whole genus.

8. **Ziziphora** L.

About 20 species distributed in S Europe, NW Africa, and Asia to Himalayas and Altai mountains.

Ziziphora tenuior L., Sp. Pl.: 21 (1753).

Description: Annual herb with simple or branched stems up to 15 cm, greenish or purplish, covered with a dense indumentum of short eglandular retrorse hairs. Leaves 7–25 × 2–6 mm, lanceolate to linear-lanceolate, elliptic, base cuneate, apex acute, margins entire, ciliate, scabrid on both surfaces, prominently veined below, sparsely gland dotted; petiole absent to 23 mm. Flowers 6–8 forming a dense oblong spike from near the base of stem. Calyx 6–8 mm, narrow tubular, scarcely 2-lipped, with short and long spreading eglandular spreading hairs and oil globules; teeth short, triangular. Corolla pale lilac to lavender or lilac, 8–10 mm, tube slightly longer than the calyx; upper lip subentire, lower lip 3-lobed. Stamens 2, included in the upper lip; stammodes present. Nutlets c. 1 mm, oblong, granulate.

Flowering and fruiting: April to May.

Distribution and habitat: Northern Oman, Musandam, on open stony areas at high elevations *Altitude*: 1200–1400 m. Distributed in SW and C Asia. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 683.

Notes: Not common and reported only from the Musandam mountains. Collected only twice, but probably under-collected or over looked, as most annuals in Oman, due to their short life and dependency on rain. A SW Asian species whose presence in Musandam is not unexpected.

9. **Lallemantia** Fisch. & Mey.

About five species distributed in SW and C Asia, one species reaching China.

Lallemantia royleana (Benth.) Benth. in DC., Prodr. 12: 404 (1848).
Synonym: *Dracocephalum royleanum* Benth. in Wall. (1830).

Description: Annual with unbranched leafy stems up to 10 cm, covered with a dense indumentum of short eglandular retrorse hairs. Leaves 15–20 × 7–15 mm, oblong-ovate, base cuneate, apex obtuse, margins crenate, pubescent with sessile glands; petiole 10–20 mm. Flowers in verticils present from near the base of stem; bracts linear-oblong, sessile or shortly petiolate, with marginal awns 2–4 mm long; pedicels markedly flattened in fruit. Calyx 6–7 mm, tubular, 2-lipped, prominently veined with short eglandular spreading hairs and few sessile oil globules; upper lip 3-lobed, lower 2-lobed, all acuminate with teeth convergent in fruit and closing the mouth. Corolla pale lilac to blue-pink, 7–8 mm, slightly longer than the calyx; upper lip with 2 longitudinal folds within, almost flat. Nutlets c. 2 mm, mucilaginous on wetting.

Flowering and fruiting: February to June.

Distribution and habitat: Northern Oman, on Musandam mountains, on wadis banks and mountains slopes. *Altitude*: 250–1600 m. Distributed in S Russia, southwest and central Asia. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia.

Distribution map & Illustration: 684.

Notes: Not common, and reported only from Musandam, it is found in Baluchistan and therefore its presence in Musandam is not unexpected. The species is often cultivated for its seeds that become mucilaginous on wetting and taken with milk and water used as a coolant in hot weather.

10. **Lavandula** L.

Distributed from the Mediterranean region south to Mauritania and Somalia, Socotra, Arabia and east through Western Asia to India, and Macaronesia.

1 Leaves entire or with 1–3-pairs of rounded or triangular lobes, spikes capitate; bracts with orbicular lateral lobes, enveloping the calyx ..... 5. **L. hasikensis**
Leaves pinnatisect to pinnatifid or lobed, spikes cylindrical, not lengthening in fruit; bracts ovate, not enveloping the calyx 2
2 Indumentum of bracts and calyx of simple and branched, long multicellular glandular hairs ..... 4. **L. samhanensis**
Indumentum of bracts and calyx of simple or glandular hairs but not long and multicellular 3
3 Plants leafy; stems and leaves tomentose to densely lanate ..... 3. **L. dhofarense**
Plants almost leafless, rarely with few leaves below; stems and leaves glabrous to sparsely hairy 4
4 Spike usually interrupted, elongating and becoming lax in fruit; glands common and regularly spaced in between nerves on calyx ..... 1. **L. macra**
Spikes condensed in fruit; glands rare in between nerves on calyx .... 2. **L. subnuda**

1. ***Lavandula macra*** Baker, Kew Bull. 1894: 339 (1894).
Type: Yemen (S), hillsides at Khailah (Hadhramaut), 3000 ft., 3.i.1894, *Lunt* 135 (holotype K; isotype BM).

Description: Woody based perennial, 30–60 cm, aromatic when crushed. Stems erect to ascending, almost leafless, branched, quadrangular, often with 4 subsidiary ribs, glabrous or sparsely pubescent with branched hairs. Leaves when present 10–15 × 2–5 mm, ovate in outline, pinnatisect; segments ± oblong, acute to obtuse, margins 0–2-toothed, sessile glandular with sparse tomentose hairs. Inflorescence of terminal or axillary spikes, usually interrupted, elongating and becoming lax in fruit; bracts 2–3 mm, ovate, acute with a spinescent tip. Calyx 4–5 mm, puberulous with sessile glands between the nerves, 5-toothed; teeth ± equal. Corolla pale blue or lilac, 11–13 mm, 2-lipped above, tubular below; tube 8–9 mm, slightly widening and curved above; upper lip erect, shallowly lobed, lower divided into 3 spreading oblong lobes. Stamens included. Nutlets ± 1 mm, oblong, mucilaginous when wet.

Flowering and Fruiting: September to May.

Distribution and habitat: Scattered throughout Oman, including Masirah and Halaniyat Islands, on the foothills of the mountains on rocky and stony hillsides, and in pockets of soil amongst stones. *Altitude*: 50–1800 m. Distributed in Somalia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 685.

2. ***Lavandula subnuda*** Benth. in DC., Prodr. 12: 148 (1848).
Type: Oman, in regno Mascate, *Aucher-Eloy* 5220 (syntypes G, K, P).
Synonym: *Lavandula bipinnata* Kuntze forma *subnuda* (Benth.) Kuntze (1891).
Vernacular names: haraq, sawmar (A).

Description: Shrub or low shrub, up to 1 m. Stems erect to straggling, branching from a woody base, quadrangular, ± glabrescent to sparsely pubescent and branched hairs. Leaves few at the base of stems, 1–4 × 0.5–1.5 cm, ovate in outline, pinnatisect with 3–5-pairs of segments, with often the apical largest; segments obovate, acute or with 1–2 teeth, mildly fragrant when crushed. Inflorescence of terminal spikes on leafless stems, up to 5 cm long, not fragrant; bracts 1.5–2 mm, triangular, with a strong median keel prolonged into an aristate tip, brown. Calyx 4.5–5 mm, puberulous with few sessile glands between nerves, 5-lobed; teeth ± equal, ovate-triangular, acute. Corolla purple to blue or pale blue, 12–13 mm, 2-lipped above, tubular below; tube ± 10 mm, widening below the middle, curved above; upper lip erect, shallowly lobed, lower divided into 3 spreading oblong lobes; stamens 4, two long and two short, not extruding from the corolla. Nutlets ± 1.5 mm, oblong, mucilaginous when wet.

Flowering and fruiting: October to May.

Distribution and habitat: Northern Oman and Musandam, on the foothills of the western

Hajar mountains, and on the Batinah plain, on dry rocky hillsides, gravely and stony places and in river beds; common. *Altitude*: 50–700 m. A regional endemic found on the northern mountains, extending into the UAE.

Distribution map & Illustration: 686.

3. ***Lavandula dhofarensis*** A.G. Mill., Notes Royal Bot. Gard. Edinb. 42(3): 511 (1985).

Description: Perennial herb, often woody based, up to 40 cm, faintly fragrant with a lemony smell. Stems erect to ascending, branched, quadrangular, tomentose to densely lanate with branched hairs. Leaves 10–30 × 8–15 mm, ovate to lanceolate in outline, pinnatisect with 3–5 pairs of segments; segments oblong or obovate, acute, obtuse or with 1–4 teeth, margins revolute or entire, densely or sparsely lanate. Inflorescence of dense terminal spikes 1.5–6 mm; bracts 4–7 mm, ovate, tips spinescent. Calyx 4–5 mm, puberulous to shortly lanate-tomentose with sessile glandular hairs between the nerves, 5-lobed, teeth, ovate to ovate-triangular, acute. Corolla purple to pale purple, 12–13 mm, 2-lipped above, tubular below; tube 8–9 mm widening about the middle and curved above; upper lip erect, ± 2 mm, shallowly 2-lobed, lower lip divided into 3 spreading oblong lobes. Stamens 4, two long and two short, not extruding from the corolla. Nutlets ± 1 mm, oblong, minutely tuberculate, mucilaginous when wet.

Plant lax, not forming dense clumps; stems tomentose, not hiding stem surface ..... a. subsp. **dhofarensis**

Plant forming dense clumps; stems densely lanate hiding stem surface ... b. subsp. **ayuensis**

a. subsp. ***dhofarensis***

Type: Oman, Dhofar, Jebal Qara, Thamrait to Salalah Road, 300 m, 1 Oct 1979, *Miller* 2394 (holotype E; isotype K).

Vernacular names: heryem, ekulun, hilben (Jibbali).

Flowering and fruiting: August to October.

Distribution and habitat: Southern Oman, Dhofar and SE. Yemen (Mahra). In Dhofar it occurs on the wet escarpment woodlands. A regional endemic.

Distribution map & Illustration: 687.

Notes: The leaves have been used in traditional medicine to cure stomach ache, treat kidney problems and for the nervous system. The pleasantly aromatic crushed leaves have been used as perfume.

b. subsp. ***ayuensis*** A.G. Mill., Notes R.B.G. Edinb. 42(3): 512 (1985).

Type: Oman, Dhofar, main Salalah–Thamrait rd., Aqabat al Hatab, 700 m, 4 Oct. 1979, *Miller* 2534 (holotype E; isotype K).

Flowering and fruiting: August to October.

Distribution and habitat: Southern Oman, Dhofar, on the drier rocky slopes and wadi beds. Endemic.

Distribution map & Illustration: 688.

Notes: No common and localised in its distribution in the Ayun area. On the National Red List is assessed here as Vulnerable [VU B2 (b)], based on its narrow distribution in Oman and continued decline of its habitat due to road building and the fast development of this area.

4. ***Lavandula samhanensis*** Upson & S.Andrews, The genus *Lavandula*: 390 (2004). Type: Oman, Dhofar, Jebel Samhan, behind cliff face opposite Mirbat, 18 Feb. 1989, *McLeish* 1032 (holotype E).

Description: Perennial herb with a woody base, up to 20 cm, aromatic. Stems erect to ascending, branched, densely white-tomentose with short branched hairs, glabrous below and becoming glabrous with age. Leaves ovate, pinnatifid with 3 pairs of rounded lobes, lobed to half the lamina, 1–15 × 1–15 mm, densely tomentose, with short to highly branched hairs, grey-green; petiole densely woolly. Inflorescence of spikes 1–2 cm; bracts ± 5 mm, ovate with long acuminate apex, hairs simple and branched, with distinctive long multicellular glandular hairs, veins parallel. Calyx violet-pink, 5–6 mm, lobes unequal, triangular; lobes 1–1.5 mm, indumentum of simple and branched, with distinctive long stalked multicellular glandular hairs and sessile glands. Corolla not seen.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on dry limestone cliffs and open rocky slopes. So far recorded from Jebel Semhan. *Altitude*: ± 500 m. Endemic.

Distribution map & Illustration: 689.

Notes: This is a poorly known species, so far known from a single collection. It has been assessed as Vulnerable [(VU D2)] by Upson & Andrews (2004) on the IUCN Red List based on the fast development of the area where found, road building and other construction.

5. ***Lavandula hasikensis*** A.G. Mill., Notes Royal Bot. Gard. Edinb. 42(3): 526 (1985). Type: Oman, Dhofar, Jebal Hasik, south of Hasik, *Miller* 6137 (holotype E; isotype K). *Vernacular names*: hilben, hilban (Jibbali).

Description: Perennial herb with a woody base, up to 30 cm. Stems erect to ascending, branched, quadrangular, densely white tomentose with short branched hairs, becoming glabrous with age. Leaves few on the stems, sessile, often adpressed on the stem, becoming smaller above, 2–15 × 2–8 mm, oblong-ovate, entire or with 1–3-pairs of rounded or triangular lobes, margins revolute, densely tomentose, with short branched hairs, grey-green. Inflorescence of 10–25-flowered small capitate spikes 10–15 mm, lengthening in fruit to 4 cm; bracts ± 3.5 mm, with ± orbicular lateral lobes and a short acute tip arising in be-

tween, lateral lobes enveloping the calyx, veins parallel, densely tomentose. Calyx 6–17 mm, 15-nerved with purple nerves, tomentose with simple and branched hairs and sessile glandular hairs between nerves; teeth subequal, acute. Corolla lilac, ± 15 mm, tubular, 2-lipped above, tubular below; tube 12 mm, widening and curved above the middle; upper lip 3 mm, lower lip divided into 3 spreading oblong lobes. Nutlets smooth, not producing mucilage on wetting.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on dry limestone mountains in open and exposed areas. So far recorded from the eastern end of Jebel Qara, near Jibjat, Jebel Semhan and Jebel Hasik, occurring on dry exposed rocky areas, often being the dominant low shrub there. *Altitude*: 950–1600 m. Endemic.

Distribution map & Illustration: 690.

Notes: A new road Jebel Hasik recently made would pose a threat to this species. More distribution data is needed for this species before a complete conservation assessment can be provided, but placed by Upson and Andrews (2004) on the Endangered category [EN B1ab(iii)] on the IUCN Red List. The species shows no clear affinities within the genus with its very distinct bracts (see Miller, op. cit. for a detailed discussion). The low shrubby habit and dense woolly indumentum is distinctive for this species which reflect the xerophytic adaptations seen in other plants growing in this and other xerophytic habitats.

11. **Ocimum** L.

Becium Lindl. (1842).

About 65 species widespread in the tropics, mostly in Africa, often cultivated in subtropical and temperate areas; commonly used as medicinal and culinary herbs.

1. Calyx 6–8 mm, enlarging to 15 mm in fruit, lower calyx lip 5 mm, with 2 minute teeth at tip; corolla 20–25 mm ..... 3. **O. dhofarense**
   Calyx 4–5 mm, enlarging to 8 mm in fruit; lower calyx lip with 4 teeth 2
2. Stems ± glabrous; calyx pilose or pubescent ..... 1. **O. basilicum**
   Stem with adpressed, retrorse hairs; calyx densely pubescent ..... 2. **O. forsskaolii**

1. ***Ocimum basilicum*** L., Sp. Pl. 597 (1753).

Vernacular name: rehan.

Description: Perennial herb or annual, up to 60 cm, aromatic. Stems quadrangular, erect or ascending, often woody at base, branching above, glabrous or puberulent with minute hairs on two opposing faces of the stem, minutely pubescent on the inflorescence axis, usually young shoots present in the axils of leaves. Leaves greenish-purple, 25–50 × 10–15 mm, elliptic to ovate, base cuneate, apex acute to cuspidate, margins entire to shallowly serrate, glabrous or with small hairs on veins beneath, glandular dotted on both surfaces. Verticils about 6-flowered, lax on the flowering axis; bracts narrowly ovate to elliptical; pedicel

up to 3–4 mm, slightly curved, ± flattened. Calyx 2-lipped, 4–5 mm, enlarging to 8 mm in fruit; upper lip of calyx formed by single upper lobe, entire, rounded at tip, decurrent into the calyx tube, curving upwards; lower lip 4-lobed with lanceolate acuminate central teeth, lateral lobes deltate, cuspidate, pubescent or pilose, sparsely gland-dotted; interior with a dense ring of hairs at throat. Corolla pink-purple or white, strongly 2-lipped, tubular below, 7–8 mm; tube straight, scarcely exceeding the calyx; upper lip 4–5 mm, subequally 4-lobed, lobes rounded; lower lip 5 mm, ± horizontal, concave. Stamens 4, exserted from corolla, filaments of the two posterior appendiculate near base. Nutlets 2 mm, dark brown to black, ± smooth, mucilaginous when wet.

Flowering and fruiting: More or less throughout the year.

Distribution and habitat: Throughout Oman, in disturbed ground near cultivations, besides roads and near habitation; an escape from cultivation. *Altitude*: 20–600 m. Probably native to Ethiopia, widely cultivated and naturalised in tropical and subtropical Asia and Africa, and SE Asia. Cultivated throughout the Arabian Peninsula and found as an escape in several countries.

Distribution map & Illustration: 691.

Notes: The leaves and seeds are used in traditional medicine for the treatment of cataract, colds, abdominal pain and diarrhoea.

2. ***Ocimum forsskaolii*** *Benth.*, Gen. Sp. Lab.: 6 (1832).

Synonyms: *Ocimum menthiifolium* Benth. (1848); *O. hadiense* sensu E.A.Bruce in Kew Bull. (1935), non *O. hadiense* Forssk. — *Plectranthus hadiensis* (Forssk.) Schweinf. ex Sprenger.

Vernacular names: rehan, sawma.

Description: Perennial herb or annual, up to 50 cm, aromatic. Stems quadrangular, much branched, erect or ascending, woody at base, adpressed pubescent or with retrorse hairs, dense on the inflorescence axis, usually young shoots present in the axils of leaves. Leaves 10–50 × 8–25 mm, ovate, base cuneate to obtuse, apex acute to obtuse, margins entire to obscurely serrate, or crisped white-pubescent, or glabrous, gland dotted on both surfaces. Verticils about 6-flowered, lax on the flowering axis, up to 20 cm; bracts ovate; pedicel up to 1–4 mm, slightly curved, ± flattened. Calyx 2-lipped, 4–5 mm, enlarging to 7 mm in fruit, pilose, gland-dotted; upper lip 2–3 mm, rounded, larger than the lower lip; lower lip with 4 spinescent teeth, central narrow triangular, laterals broadly ovate. Corolla pale pink, strongly 2-lipped, tubular below, 10–12 mm; tube 5 mm, funnel-shaped, exceeding the calyx, upper lip 4–5 mm, subequally 4-lobed, lobes rounded; lower lip 5 mm, horizontal, concave. Stamens 4, exserted from corolla. Nutlets 2 mm, reddish-brown, smooth, mucilaginous when wet.

Flowering and fruiting: February to April; September/October.

Distribution and habitat: Southern Oman, Dhofar, on the wet escarpment woodlands, with *Anogeissus* etc. *Altitude*: 100–1300 m. Distributed in tropical NE Africa (Sudan, Eritrea,

Ethiopia and Somalia), Egypt. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 692.

Notes: Wild collected seed of this species is held at the Millennium Seed Bank at Wakehurst Place, Royal Botanic Gardens, Kew.

3. ***Ocimum dhofarense*** (Sebald) A.J.Paton in Hiltunen & Holm (eds.), Basil. Genus Ocimum: 35 (1999).
Synonyms: *Becium dhofarense* Sebald (1987). Type: Dhofar mountains, 1895, *Th. Bent* (holotype K); *Orthosiphon comosus* Baker (1895) nom. illeg. non *O. comosus* Wight ex Benth. (1848).
Vernacular name: hodem (Jibbali)

Description: Shrub, up to 2 m. Stems purplish-green, rounded or quadrangular, erect, glandular-tomentose, becoming glabrous. Leaves 20–80 × 10–50 mm, ovate, base cuneate to obtuse, apex acute to obtuse, margins crenate-serrate, thinly hairy on veins, gland-dotted with yellow sessile glands. Verticils 2–6-flowered, in spikes crowded at the tips of spike, lengthening and becoming lax in fruit; spike crowned with a tuft of sterile bracts; bracts pinkish, 3–8 mm, linear; pedicel 0.5–1 mm. Calyx 2-lipped, 6–8 mm, enlarging to 15 mm in fruit, white tomentose, gland-dotted; upper lip 6 mm, ovate; lower lip 5 mm, with 2 minute teeth at tip. Corolla pink, strongly 2-lipped, tubular below, 20–25 mm, tube 10–18 mm, widening at mouth; upper lip 5 mm, 4-lobed, lobes rounded; lower lip 5–6 mm, horizontal, concave. Stamens 4, long exserted from corolla; filaments noticeably curling back after dehiscence. Nutlets 2 mm, brown, smooth.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the wet escarpment mountains, in *Anogeissus dhofarica* woodland, common. *Altitude*: 500–900 m. A regional endemic also found in SE Yemen.

Distribution map & Illustration: 693.

Notes: Leaves used as fodder after the monsoon. The juice from the leaves has been used by women to stain skin an orange-yellow colour. Juice from plant has been used in traditional medicine to treat skin problems, itchy and irritated eyes and as a washing agent.

12. **Orthosiphon** Benth.
About 40 species distributed in tropical and southern Africa, Madagascar and tropical and subtropical Asia.

Orthosiphon pallidus Royle ex Benth. in Hook., Bot. Misc. 3: 370 (1833).
Synonyms: *Ocimum reflexum* Schweinf. (1867); *Orthosiphon reflexus* (Ehrenb. ex Schweinf.) Vatke var. *pallidus* (Benth.) Terrac. (1893).

Description: Annual or short-lived perennial herb with a woody base, up to 40 cm. Stems quadrangular, much branched, pubescent with eglandular retrorse hairs, sometimes hairs patent on the inflorescence axis. Leaves 15–35 × 10–20(–30) mm, ovate, base attenuate, apex obtuse, margins crenate or obtusely serrate, glandular-punctate and pubescent with spreading hairs on veins on the under surface; petiole 8–25 mm. Verticils lax; bracts ± 1 mm long; pedicels ± 3 mm, patent, slightly flattened, curved distally. Calyx horizontal or downward-pointing, downward pointing when fruiting, 2-lipped, 6–7 mm; upper lip ovate, entire; lower lip 4-lobed with lateral lobes deltate, cuspidate, median lobes lanceolate, acuminate, pubescent, hairs long, sessile glands present. Corolla white, 2-lipped, tubular, 4–5 mm, dilating slightly towards throat; upper lip 4-lobed with the median lobes narrower; lower lip cucullate, enclosing stamens when young; stamens 4, glabrous. Nutlets 1.5 mm, minutely tuberculate, brown, producing a very small amount of mucilage when wet.

Flowering and fruiting: September/October.

Distribution and habitat: Southern Oman, Dhofar, on the lower altitudes of the escarpment mountains, coastal plains, and along track roads, with *Commiphora* and *Acacia*. *Altitude*: 20–800 m. Distributed in W, E and NE Africa, Arabian Peninsula, India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 694.

Notes: Wild collected seed of this species is held at the Millennium Seed Bank at Wakehurst Place, Royal Botanic Gardens, Kew.

13. **Endostemon** N.E.Br.

A genus of 18 species found mainly in tropical and southern Africa, southern Arabia; one species in India and one in Madagascar.

Endostemon tenuiflorus (Benth.) Ashby, J. Bot. 74: 125 (1936).

Synonym: *Orthosiphon tenuiflorus* Benth. in DC. (1848). Type: Yemen, *Botta* s.n. (holotype P; isotype K).

Vernacular names: hodem, siot (Jibbali).

Description: Annual or short-lived perennial woody herb, aromatic. Stems erect to ascending, quadrangular, 15–20 cm, woody at base, pubescent with short or long, spreading eglandular and glandular hairs. Leaves sessile, 8–10 × 3–4 mm, oblanceolate, base attenuate or cuneate, apex round or obtuse, margins irregularly crenate, glandular-punctate and white-pubescent. Inflorescence with 2-flowered verticils, lax, bracts ± 1 mm, white-hairy; pedicels 2 mm, erect or ascending. Calyx persistent, with an upper lobe ± 3 mm, the lower lobe ± 4 mm, of three linear segments. Corolla pink with white tube, 9–12 mm, tube narrow, exserted from the calyx, white-pubescent, expanding at throat, 4-lobed above. Stamens with villose filaments, included in the corolla tube. Nutlets ± 2 mm, black, ovoid, smooth, mucilaginous when wet.

Flowering and fruiting: September to February.

Distribution and habitat: Southern Oman, Dhofar, amongst rocks, and crevices of rocks. *Altitude*: 10–1850 m. Distributed in Sudan, Ethiopia, Somalia, Zimbabwe, Botswana, Namibia, South Africa and Madagascar. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration: 695.

14. **Plectranthus** L' Hér.
Coleus Lour.
About 300 species distributed in the Old World tropics.

Inflorescence axis of lax verticils up to 30 cm long, glandular ..... 1. **P. barbatus**
Inflorescence in lax spikes, terminal and in axils of leaves, verticils ± congested, eglandular ..... 2. **P. montanus**

1. ***Plectranthus barbatus*** Andr., Bot. Rep. 9, t. 594 (1809).
Synonyms: *Coleus barbatus* (Andr.) Benth. (1830).
Vernacular names: zefubrek, defroegh.

Description: Perennial succulent shrub, often forming large clumps, up to 60 cm tall, aromatic. Stems erect or ascending, sometimes creeping at base, ± brittle, rounded-quadrangular, branched, pubescent to villous, glandular and/or eglandular with red sessile glands. Leaves opposite, fleshy, 5–20 × 2–6 cm, elliptic to ovate, base cuneate to rounded, apex obtuse, margins serrate or crenate, pubescent to tomentose, densely red sessile glands beneath; petiole 1–5 cm. Inflorescence axis of lax verticils up to 30 cm long, glandular, viscid; bracts ovate, deciduous, pedicels 3–4 mm, ascending, slightly flattened, distally curved. Calyx 3–5 mm, 2-lipped, villous at base, upper lip ovate, abruptly acuminate; lower lip with 4 narrow acute teeth. Corolla purplish blue, 1.7–2 cm, 2-lipped; upper lip erect, 2-lobed at apex with 2 small lateral lobes, lower lip much longer than upper lip, cucullate. Stamens 4, attached at the mouth of the corolla tube, placed in the lower lip; filaments fused at base. Nutlets 1.5 mm, ellipsoid, shiny black, mucilaginous when wet.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, on rocky outcrops and small cliffs on summit grasslands, and in *Euphorbia balsamifera* zone, with *Commiphora* and *Acacia*. *Altitude*: 700–1200 m. Distributed in E and NE Africa (Uganda, Kenya, Tanzania, Sudan, Eritrea, Ethiopia, Somalia), Arabia, India and tropical Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 696.

Notes: Cultivated in many parts of the world including Oman. Our plants are referable to var. *barbatus*. *Plectranthus rotundifolius* (Poir.) Spreng. (Syn.: *Coleus rugosus* Benth.), a

native of Mauritius, is reported to be cultivated in Oman, but I have not seen any material of this species.

Wild collected seed of this species is held at the Millennium Seed Bank at Wakehurst Place, Royal Botanic Gardens, Kew.

2. ***Plectranthus montanus*** Benth. in Wallich, Pl. Asiat. Rar. 2: 17 (1830).
Synonyms: *Plectranthus cylindraceus* Benth. (1848); *P. marrubioides* Benth. (1848).

Description: Perennial succulent shrub, sometimes forming clumps, up to 60 cm tall, aromatic. Stems often pinkish-green, erect or ascending, ± brittle, rounded-quadrangular, branched, with short axillary shoots, pubescent to tomentose, eglandular with yellowish sessile glands. Leaves opposite, fleshy, 1.2–6 × 0.5–2.25 cm, elliptic to obovate, base tapering into petiole, apex obtuse, margins serrate or crenate, pubescent to tomentose, with yellowish sessile glands. Inflorescence in lax spikes, terminal or in axils of leaves, verticils ± congested, eglandular; bracts ovate to elliptic, deciduous; pedicels 2–3 mm, ascending, slightly flattened, distally curved, attached eccentrically behind the posterior lip. Calyx 1.5 mm, fruiting calyx 2–3 mm, 2-lipped, densely tomentose with white hairs and with yellowish or orange sessile glands; upper lip purplish, narrow elliptic, acute; lower lip with 4 lanceolate lobes, median lobes deeply slit. Corolla bluish or violet, 3–5 mm, 2-lipped; upper lip erect, 2-lobed at apex with 2 small lateral lobes; lower lip much longer than upper lip, shallow cucullate. Stamens 4, attached at the mouth of the corolla tube, placed in the lower lip, filaments free. Nutlets 1.5 mm, ellipsoid, shiny brown, mucilaginous when wet.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on relatively drier areas of the escarpments mountains, on rocky outcrops and small cliffs on summit grasslands with *Commiphora* and *Acacia*. *Altitude*: 700–1200 m. Distributed in E, W and NE Africa (Congo-Kinshasa, Rwanda, Burundi, Sudan, Ethiopia, Eritrea, Somalia, Angola, Zambia, Malawi, Mozambique, Zimbabwe, Botswana) and southern Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 697.

Notes: Distinctive in all plant parts being strongly aromatic; the leaves when crushed smell of "Dettol".

15. **Premna** L.
About 200 species distributed in the Arabian Peninsula and Egypt, tropical Africa to South Africa and Indian Ocean Islands, India to Japan and through tropical Asia to Australia and S and W Pacific.

Premna resinosa (Hochst.) Schauerin in DC., Prodr. 11: 637 (1847).
Vernacular names: shohit, sebhit.

Description: Straggly shrub up to 2 m; stems with whitish bark, sparsely white-tomentose and with sessile glandular hairs, becoming glabrous with age; the whole plant aromatic. Leaves opposite, 8–30 × 3–10 mm, ovate to ovate-oblong, base rounded, apex obtuse, margins entire, glabrous, gland-dotted, densely so on the under surface; petiole 3–10 mm. Flowers in terminal corymbose cymes, glandular. Calyx ± 1 mm, campanulate, 5-lobed above; lobes triangular, pubescent and glandular. Corolla white to pale yellow, 6–7 mm, tubular below, 2-lipped above; tube ± 3 mm, densely hoary at the mouth; upper lip rounded, hooded, lower lip 3-lobed; lobes oblong, rounded. Stamens 4, included in the upper lip of the corolla. Style simple. Fruit ± 5 mm in diameter, globose with persistent calyx below, fleshy, ripening dark red or brown, 2–4-seeded, edible.

Flowering and fruiting: September to November.

Distribution and habitat: Southern Oman, Dhofar, in the drier areas, on hill slopes and plateau of the escarpment hills, and on plains the lower foothills, in the dry *Acacia-Commiphora* woodland. *Altitude*: 450–1000 m. Distributed in Sudan, Ethiopia, E. Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 698.

16. **Vitex** L.

About 250 species, pantropical and warm temperate in distribution, from the Mediterranean region and Middle Asia to South Africa and Australasia, and Mexico to Argentina.

Vitex agnus-castus L., Sp. Pl. 2: 638 (1753).

Vernacular name: arshad. *Common English names*: Chaste tree, chasteberry, Monk's pepper.

Description: Small tree or shrub, up to 2 m. Leaves opposite, grey-green, 5-foliolate; leaflets (2–)5–10(–12) × (4–)10–15(–20) mm, lanceolate, base tapering to a short petiole, apex ± acuminate, margins entire, white-tomentose. Flowers in long terminal or axillary cymes, spreading, aromatic. Calyx ± 3 mm, campanulate, 5-toothed, persistent, forming a cup-like structure below the fruit. Corolla white, blue or purple, 7–10 mm, 2-lipped, 4-lobed; lower lobes ± pubescent. Stamens 4, inserted in the corolla tube, exserted. Fruit an indehiscent drupe, ± 2 mm in diameter, 4-celled, fleshy, glabrous.

Flowering & fruiting: December to March.

Distribution and habitat: Northern Oman, on the foothills of the Hajar mountains, in wadis, near villages. Indigenous to the Mediterranean region, cultivated and naturalised in many warm regions of the world; naturalised in Oman, and also found as escape near villages. Widely cultivated in public parks and private homes in several countries of the Arabian Peninsula.

Distribution map & Illustration: 699.

79. **Plantaginaceae**

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Traditionally a family of three genera and about 270 species (as treated in this Flora), but molecular evidence (citations above) suggests that the family should be extended to include several genera from the Scrophulariaceae (see under Scrophulariaceae) and Globulariaceae.

Plantago L.

About 270 species, cosmopolitan in distribution.

1. Leaves ovate, up to 6.5 cm broad; spikes narrowly cylindrical; sepals equal ..... 5. **P. major**
   Leaves lanceolate to linear-lanceolate, ± 6 cm broad; spikes ovate-cylindrical to cylindrical 2
2. Leaves not in a basal rosette, sparsely pilose to glabrous ..... 1. **P. amplexicaulis**
   Leaves in a basal rosette, pilose to densely villous 3
3. Bracts pilose on the midrib or glabrous or shortly pubescent dorsally; calyx lobes glabrous ..... 2. **P. ovata**
   Bracts densely pilose; calyx pilose 4
4. Leaves lanceolate; spikes narrow cylindrical, congested above, often lax below; peduncles 10–15(–30) cm; calyx lobes almost equal, margins ciliate, dorsally covered with long hairs ..... 3. **P. albicans**
   Leaves lanceolate to lanceolate-spatulate; spikes ovate to ovate-cylindrical, congested; peduncles up to 7 cm; calyx lobes unequal, margins ciliate, not covered with long hairs ..... 4. **P. ciliata**

1. ***Plantago amplexicaulis*** Cav., Icon. et Descr. Pl. Hisp. 2: 22, t. 125 (1793).

Description: Annual up to 35 cm. Stem short with leaves alternate, arising along from the base of stem. Leaves 8–20 × 0.3–0.8 cm, lanceolate, base tapering, apex acute, margins entire to distantly denticulate, ± sparsely pilose to glabrous, 3–5-veined, greyish-green above, dull green beneath. Flowers in pedunculate, congested spikes, peduncles stout, up to 30 cm, glabrous, spikes ovate to cylindrical up to 2 cm; bracts 4–6 mm, ovate, glabrous, midrib dark brown, margins wide, scarious. Calyx 4-lobed, 3–4 mm, lobes unequal, glabrous. Corolla tubular, 4-lobed above; tube 3–4 mm, glabrous, lobes 3–4 mm, ovate, acute. Stamens 4, exserted. Capsule 5–6 mm, pale pinkish-brown, membranous, dehiscence circumsessile near the middle. Seeds 2, 3–5 mm, oblong, brownish.

Flowering and fruiting: March/April.

Distribution and habitat: Northern Oman, in the foothills of the Hajar mountains and on

the Batinah plain, in wadi beds, cultivated and irrigated areas, in sand and silt amongst stones, silty depressions, mostly in shade. *Altitude*: 250–500 m. Distributed in North Africa, through the Arabian Peninsula, Iraq, Iran to Pakistan and western India. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 700.

2. ***Plantago ovata*** Forssk., Fl. Aegypt.-Arab.: 31 (1775).
var. ***ovata***

Description: Delicate annual herb, 3–12 cm. Stem short with leaves forming a basal rosette; leaves 15–100 × 2–2.5 mm, linear-lanceolate, base tapering, apex acute, margins entire or with a few denticulations, densely pilose, 1-veined, greyish-green. Flowers in pedunculate congested spikes; peduncles up to 10(–16) cm, pilose; spikes ovate to ovate-cylindrical, up to 2 cm; bracts ± 3 mm, ovate; midrib green to brownish green, margins wide scarious, pilose on the midrib or glabrous or sometimes shortly pubescent. Calyx 4-lobed, 2–3 mm, lobes unequal, glabrous. Corolla tubular, 4-lobed above; tube ± 2 mm, glabrous; lobes ± 2 mm, broadly ovate, apiculate. Stamens 4, exserted. Capsule 3 mm, pale brown, membranous when mature, dehiscence circumsessile. Seeds 2, ± 2 mm, oblong, brownish.

Flowering and fruiting: February to April; September.

Distribution and habitat: Northern and southern Oman, including Musandam, in the foothills of the Hajar mountains and on the Batinah plain, in muddy wadi beds, cultivated and irrigated areas, in sandy and silty locations, silty depressions, mostly in shade. *Altitude*: 20–300 m. Distributed in North Africa, through the Arabian Peninsula, Iraq, Iran to Pakistan and western India; Canary Islands, Madeira, SE Spain. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 701.

3. ***Plantago albicans*** L., Sp. Pl. 1: 114 (1753).
Synonym: Plantago boissieri Hausskn. & Bornm. ex Bornm. (1894).

Description: Annual or sometimes perennial herb, up to 10 cm. Stem short with leaves forming a basal rosette, densely sericeous to long villous. Leaves 30–70 × 5–12 mm, lanceolate, base tapering, apex acute, margins entire, densely white villous, 1–3-veined, greyish-green. Flowers in pedunculate spikes, congested above, often lax below (sometimes very lax throughout as in *Miller & Nyberg* M 9318 from Dhofar), peduncles 10–15(–30) cm, villous; spikes cylindrical, usually up to 2 cm, elongating to 10(–30) cm; bracts 2.5–3 mm, concave, ovate with scarious margins, villous-ciliate, pubescent to sparse villous dorsally. Calyx 4-lobed, 2–3 mm, lobes almost equal, margins ciliate, dorsally covered with long hairs, midrib green to brownish, weakly keeled. Corolla tubular, 4-lobed above, chaffy; tube ± 2 mm, glabrous; lobes ± 1.5 mm, ovate, acute, glabrous. Stamens 4, exserted. Capsule enclosed in calyx, 3 mm, pale brown, membranous, dehiscence circumsessile.

near the middle, the lid and seeds falling with the corolla limb. Seeds 2, ± 2.5 mm, oblong, brownish.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, in the drier areas, on hill slopes, in sandy soil. *Altitude*: 600–1300 m. Distributed from southern Mediterranean through Turkey, Syria, Palestine and Iraq, Arabian Peninsula to Egypt and NE Africa. Elsewhere in the Arabian Peninsula found in Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 702.

Notes: This species is reported to be abundant and common in Eastern Saudi Arabia by Mandaville (Fl. of Eastern Saudi Arabia 1990: 269), but it is not found commonly in Oman. *Miller & Nyberg* 9318 is different with its very long and lax inflorescence (mature), but is referable to this species in all other characters.

4. ***Plantago ciliata*** Desf., Fl. Atlant. 1: 137. t. 39, fig. 3 (1769).

Description: Annual or sometimes perennial herb, up to 10 cm. Stem very short or absent, with leaves forming a basal rosette, densely woolly to sericeous; leaves 30–60 × 4–18 mm, lanceolate to lanceolate-spatulate, base tapering, apex acute, margins entire or with a few denticulations, densely white-woolly, 1-veined, greyish-green. Flowers in peduncular, congested spikes; peduncles up to 7 cm, woolly; spikes ovate to ovate-cylindrical, up to 2 cm; bracts ± 3 mm, concave, ovate, margins ciliate, dorsally covered with long hairs, midrib green to brownish keeled. Calyx 4-lobed, 2–3 mm, lobes unequal, margins ciliate. Corolla tubular, 4-lobed above; tube ± 2 mm, glabrous; lobes ± 1.5 mm, broadly ovate, acute. Stamens 4, exserted. Capsule 3 mm, pale brown, membranous when mature, dehiscence circumsessile. Seeds 2, ± 2.5 mm, oblong, brownish.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, in the foothills of the Hajar mountains, in wadi beds and banks, moist disturbed places and silty depressions, and in irrigated places. *Altitude*: 80–400 m. Distributed in North Africa through the Arabian Peninsula, Iraq, Iran, Pakistan to India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 703.

Notes: Kazmi (Fl. Pakistan, 1974: No. 62, p. 18) separates the southwest Asian material as subsp. *lanata* (Boiss.) Rech.f. based on its narrower anterior sepal.

5. ***Plantago major*** L., Sp. Pl. 1: 112 (1753).
Vernacular name: lisan al kalb.

Description: Annual herb, up to 25 cm. Stem short with leaves forming a basal rosette, leaves 6–10 × 4.5–6.5 cm, ovate, base cuneate, tapering to form a long petiole up to 6 cm, apex obtuse to acute, margins entire, ± minutely pubescent to glabrous, 3–5-veined from

the base. Flowers in pedunculate, narrow cylindrical spikes 5–11 cm, congested above, becoming lax below; peduncles stout, up to 24 cm, glabrous; bracts ± 3 mm, ovate, keeled, glabrous. Calyx 4-lobed, 1.5–2 mm, lobes equal, glabrous. Corolla tubular, 4-lobed above; tube glabrous; lobes ± 2 mm, ovate, acute. Stamens 4, exserted. Capsule ± 3 mm, pale brown, dehiscence circumsessile. Seeds 8, oblong, brownish.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, in the Hajar mountains, in cultivated and irrigated areas, abandoned fields, moist disturbed places and silty depressions, mostly in shade. *Altitude*: 1800–2500 m. Native of Europe and Central Asia, naturalised in most parts of the world. Elsewhere in the Arabian Peninsula found in Saudi Arabia, ?UAE, Yemen.

Distribution map & Illustration: 704.

Notes: The species is mainly found near villages; it is loved by all livestock.

80. **Oleaceae**

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Key to the genera of Oleaceae in Oman

Leaves 3–5-foliolate; fruit 2-lobed ..... 1. **Jasminum**
Leaves simple; fruit not lobed ..... 2. **Olea**

1. **Jasminum** L.

About 200 species distributed in the tropics and subtropics of the Old World; rarely found in temperate regions.

Jasminum grandiflorum L., Sp. Pl. ed. 2: 9 (1762).
subsp. ***floribundum*** (R.Br. ex Fresen.) P.S.Green, Kew Bull. 41: 414 (1986).

Synonym: *Jasminum floribundum* R.Br. ex Fresen. (1837).

Vernacular name: yasmeen.

Description: Perennial herb with trailing or scrambling stems, up to 3 m. Leaves opposite, pinnately 3–5-foliolate; lobes 15–50 × 10–25 mm, ovate, base rounded to cuneate, apex acute to acuminate, margins entire, the terminal lobes largest, the laterals ± asymmetrical, glabrous to glabrescent. Inflorescence terminal and axillary, cymose, lax and few-flowered; flowers fragrant. Calyx ± 5 mm, lobed with 5 linear, acuminate teeth. Corolla white, tubular, 5-lobed above; tube 14–17 mm, sometimes flushed pink; lobes 15–16 mm, obovate,

acute to sometimes emarginate, spreading. Stamens 2, included. Fruit fleshy, 2-lobed (one often aborting), each lobe 1-seeded, purple-black when mature.

Flowering and fruiting: August to October; but also flowering in March and April.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment hills in open woodland, climbing over shrubs and trees; common. *Altitude*: 200–700 m. Distributed from tropical NE Africa to SW Arabia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 705.

Notes: The flowers are fragrant and appreciated locally for their scent, and often cultivated in homes. The leaves of this species have been used in traditional medicine to treat dysentery, abdominal pain and colic; also used as an emollient. Several species of *Jasminum*, especially *J. sambac* (simple leaved shrub) is widely cultivated in private gardens for the fragrant flowers.

2. **Olea** L.

Thirty-three species distributed in Africa, Macaronesia and Asia.

Olea europaea, the olive, one of the world's major economic plants, is considered an ancient cultigen as is not known in the wild. However wild forms of this species with smaller fruits are known over a wide area.

Olea europaea L., Sp. Pl., 1: 8 (1753).

subsp. ***cuspidata*** (Wall. ex G.Don) Cif., L'Olivicoltore 19(5): 96 (1942).

Basionym: *Olea cuspidata* Wall. ex G.Don (1837). *Synonyms*: *Olea africana* Mill. (1768); *O. chrysophylla* Lam. (1791); *Olea somaliensis* Baker (1902); *O. europaea* L. var. *cuspidata* (Wall. ex G.Don) Cif. (1942); *O. chrysophylla* Lam. var. *aucheri* A.Chev. (1948) nom. nud.; *O. aucheri* A.Chev. ex Lhrend. (1960). Type: Oman, *Aucher-Eloy* 4918 (holotype P; isotypes G, K); *O. europaea* L. subsp. *africana* P.S.Green (1979). (Only synonyms relevant to this area are given here).

Description: Evergreen tree or large shrub, up to 10 m with a rough grey bark. Leaves opposite, simple, coriaceous, 2–6 × 1–2 cm, lanceolate to elliptic, apex acute, base cuneate, margins entire, shiny-green above, brownish-green below, lower surface covered with brownish-green peltate scales, upper glabrous or with scattered scales. Inflorescence of short terminal or axillary panicles; flowers fragrant; bracts minute. Calyx 4-lobed, ± 1 mm, cup-like. Corolla white or cream, 4-lobed; lobes 1–2 mm. Stamens 2, exserted, filaments attached near the top of the corolla tube. Ovary 2-locular. Drupe ± 15 mm long, ellipsoid, 1-seeded, with a fleshy mesocarp, turning blue-black when ripe.

Flowering and fruiting: May to June; fruits maturing in August.

Distribution and habitat: Northern and southern Oman, on the western and eastern Hajar mountains in northern Oman and on the Dhofar mountains in southern Oman, at high al-

titudes and on summit grassland. On the Hajar mountains with *Sideroxylon mascatense*, *Juniperus*, *Dodonaea viscosa*, *Ziziphus hajarensis*, and *Ceratonia oreothauma* (Eastern Hajar); in Dhofar on the escarpment woodlands in *Anogeissus*–*Delonix* woodland. *Altitude*: 900–2900 m. Widespread from South to NE Africa to the drier parts of China. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen, UAE.

Distribution map & Illustration: 706.

Notes: The fruits of the wild olive are not eaten, being mostly bitter to taste, nor used for extracting oil, but at certain locations on the western Hajar mountains the fruits are sweet and edible. The wood is resistant to termites and has been used for building and for making utilitarian implements, firewood, and for making charcoal. The branches have been used for making "throwing sticks" used as a weapon in Dhofar (see Miller & Morris, 1988: 216). The foliage is lopped as fodder. In northern Oman, even though the species is widespread and common, there are very few locations where the trees are in good condition and very little or no regeneration is evident. On the National Red List this species is assessed Least Concern (LC), but is close to being Near Threatened (NT).

81. **Scrophulariaceae**

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Recent molecular studies (Olmstead et al., 2001 & Oxelman et al., 2005) have shown the Scrophulariaceae s.l. to consist of 5 monophyletic groups with *Mimulus* not belonging to any of the groups. The families accepted by them include (for Oman flora) Orobanchaceae (including parasitic and semiparasitic genera), Scrophulariaceae s.str. and Veronicaceae. Fischer (2004) accepts all genera traditionally included in the Scrophulariaceae except *Lindenbergia*. In the APG III (2009) system, Scrophulariaceae s.l. is split with several genera moved to other families. In the Oman flora *Bacopa*, *Linaria*, *Misopates*, *Nanorrhinum*, *Schweinfurthia* and *Veronica* would be included in the expanded Plantaginaceae.

I am treating Scrophulariaceae in the traditional broad sense, and including *Lindenbergia*, but keeping *Orobanche* and *Cistanche* in a separate family, Orobanchaceae.

Key the genera of Scrophulariaceae in Oman

1. Corolla 2-lipped, with a distinct upper and lower lip 2
   Corolla with ± equal lobes, but never 2-lipped 8
2. Corolla tube produced as a spur at the base 3
   Corolla tube without a spur 4
3. Leaves all alternate, never whorled; leaves (at least always some) hastate or sagittate at base ..... 3. **Nanorrhinum**
   Leaves whorled below, alternate above; leaves never hastate or sagittate at base ..... 4. **Linaria**
4. Semi-parasitic plants; corolla tube bent at right angles or curved above the middle ..... 15. **Striga**
   Plants not parasitic; corolla tube straight 5
5. Leaf margins dentate; orbicular scale-like staminode present ..... 6. **Scrophularia**
   Leaf margins ± entire; staminode absent 6
6. Corolla tube saccate at base; capsule obliquely ovoid ..... 2. **Misopates**
   Corolla tube not saccate at base; capsule not obliquely ovoid 7
7. Calyx deeply divided into lobes; lobes unequal; stamens 4, fifth reduced to a staminode; anther cells not stipitate ..... 1. **Schweinfurthia**
   Calyx lobed to half its length; lobes equal; stamens 5; anther cells stipitate ..... 8. **Lindenbergia**
8. Stamens 2 9
   Stamens 4 10
9. Shrubs and subshrubs; corolla tube narrow cylindrical, geniculate twice (one may be hidden in the calyx) ..... 11. **Campylanthus**
   Annual herbs; corolla tube campanulate, not geniculate ..... 12. **Anticharis**
10. Stems densely villous (except *V. akhdarense*); hairs stellate; filaments pilose; anther cells confluent ..... 5. **Verbascum**
    Stems not densely pilose; hairs not stellate; filaments pilose or not; anther cells not as above 11
11. Leaves with dentate to serrate margins 12
    Leaves with ± entire margins 13
12. Plant glabrous or stems very sparsely glandular ..... 13. **Veronica**
    Plant with long glandular hairs ..... 7. **Camptoloma**
13. Stem very reduced; basal rosette of leaves present; filaments sharply angled about the middle ..... 10. **Craterostigma**
    Stem not reduced; basal leaves not rosetted; filaments straight 14
14. Semi-parasitic herb, blackening on drying or not; calyx 10-nerved 15
    Plants not parasitic nor blackening on drying; calyx not 10-nerved 16
15. Leaves few on the stem, thick and scale-like; corolla 4-lobed, yellow ..... 14. **Alectra**
    Leaves linear to linear-lanceolate; corolla 5-lobed, blue, mauve or white ..... 16. **Buchnera**

16. Perennial herbs; stems ascending; calyx lobes unequal, the outer 3 largest, broadly ovate, inner 2 smaller, lanceolate; corolla blue ..... 9. **Bacopa**
Annual herbs; stems erect; calyx lobes equal; corolla pink ..... 17. **Leptorhabdos**

1. **Schweinfurthia** A.Braun

Six species distributed from western India, Pakistan, and Afghanistan through Iran to the Arabian Peninsula, Egypt, Sudan, Ethiopia and Somalia.

1. Leaves 7–60 × 7–30 mm, broadly spatulate to orbicular; flowers 12 mm or more long, upper calyx lobe 9–15 mm, broadly ovate 2
Leaves in general smaller than above, broadly spatulate to orbicular, oblanceolate, oblong or linear; flowers up to 10 mm long; upper calyx lobe up to 9 mm, suborbicular to lanceolate 3
2. Calyx lobes with narrow hyaline margins, glabrous; seeds with ridges and tubercles ..... 1. **S. papilionacea**
Calyx lobes thickened at margins, densely glandular-pubescent; seeds tuberculate ..... 5. **S. latifolia**
3. Prostrate herbs adpressed to the ground; leaves closely overlapping ..... 2. **S. imbricata**
Erect herbs or with ascending to decumbent stems, never prostrate 4
4. Stems spinescent; leaves broadly spatulate to orbicular ..... 3. **S. spinosa**
Stems not spinescent; leaves linear to oblanceolate 5
5. Only the upper part of pedicels reflexing; upper calyx lobe 3–5 mm, herbaceous ..... 6. **S. pedicellata**
Pedicels recurving in fruit; upper calyx lobe 3–5 mm, somewhat scarious ..... 4. **S. pterosperma**

1. ***Schweinfurthia papilionacea*** (L.) Boiss., Fl. Or. 4: 387 (1879).

Synonym: Antirrhinum papilionaceum L. (1767).

Description: Perennial herb with a woody base. Stems ± erect to ascending or decumbent, up to 40 cm, glaucous, glabrescent, young shoots pubescent. Leaves 7–60 × 7–30 mm, spatulate to orbicular, somewhat fleshy, glabrous, mucronate, obtuse, base gradually tapering into the petiole, 2–3 mm. Flowers axillary in lax racemes; pedicels 5–7 mm, elongating in fruit to 14 mm, becoming recurved. Calyx lobes unequal, with narrow hyaline margins; upper lobe 9–15 mm, broadly ovate, obtuse, mucronate; lower lobe 5–10 mm, ovate; median lobes 5–9 mm, lanceolate. Corolla white to cream with purple veins, 12–14 mm, upper lip 2 fid, lower lip 3-fid with a conspicuous yellow palate. Stamens 4. Capsule 7–10 mm, globose, glabrous, with unequal locules. Seeds with ridges and tubercles.

Flowering and fruiting: January to May (fruiting) in northern Oman; September to October in Dhofar.

Distribution and habitat: Northern and southern Oman, including Musandam, in the foot-

hills of the eastern and western Hajar mountains, in gravely wadi beds, open sandy and stony desert, besides roads, and in disturbed locations; common. *Altitude*: 10–500 m. Distributed from India, Pakistan and Afghanistan through Iran to Yemen. Elsewhere in the Arabian Peninsula found in UAE, Yemen.

Distribution map & Illustration: 707.

2. ***Schweinfurthia imbricata*** Miller, Short & Sutton, Notes R.B.G. Edinb. 40(1): 28 (1982). Type: Oman, Jebal Akhdar, Al Hijir, Wadi Bani Kharus, 24 Oct. 1979, *Miller & Whitcombe* 2804 (holotype E; isotype BM, K).

Description: Annual or perennial herb. Stems prostrate, branching from the base, up to 14 cm, woody at base, glabrescent; young stems woolly. Leaves overlapping or closely placed on the stems, 4–13 × 4–13 mm, orbicular to broadly spatulate, thick and somewhat succulent, margins hyaline, obtuse to mucronate, truncate or base attenuate. Flowers in dense racemes; pedicels 3–6 mm, reflexed in fruit. Calyx 5-lobed, lobes unequal, somewhat scarious, upper lobe 7–9 mm, suborbicular, median and lower lobes smaller, 5–8 mm, linear-lanceolate to lanceolate. Corolla 2-lipped, 8–10 mm, white or cream with purple veins, palate pale yellow. Capsule 5–10 mm. Seeds with inflated (papillate) ridges.

Flowering and fruiting: February to March; September to November.

Distribution and habitat: Northern Oman, in the foothills of the northern mountains, and on Masirah Island, in sandy and gravelly soils, and sandy wadi fans. *Altitude*: 20–700 m. A regional endemic, also found in northern UAE.

Distribution map & Illustration: 708.

3. ***Schweinfurthia spinosa*** Miller, Short & Sutton, Notes R.B.G. Edinb. 40(1): 37, fig. 2, 4, plate 3, C–F, (1982).
Type: Oman, Dhofar, Jebal Qara, 20 km N of Raven's Roost on main Thamrait to Salalah road, 13 October 1979, *Miller* 2726 (holotype E; isotypes BM, K).

Description: Perennial shrub up to 1 m. Stems erect, woody, spinescent, branching divaricate, glaucous, glabrescent, young stems white pubescent. Leaves alternate, 1.5–8 × 1.5–6 mm, spatulate to orbicular, somewhat fleshy, glabrous, mucronate, obtuse, base gradually tapering into the petiole, 1–3 mm. Flowers solitary, axillary in lax racemes; pedicels filiform, 2–7 mm, becoming recurved. Calyx lobes unequal, acute with narrow hyaline margins; upper lobe 3–4 mm, broadly ovate; lower lobe 1–3 mm, ovate, median lobes1.5–2 mm, lanceolate. Corolla pale yellow with purple veins, 6–7 mm, upper lip 2-fid, lower lip 3-fid with a prominent palate. Stamens 4. Capsule 5–6 mm, ovoid to globose, glabrous, with unequal locules. Seeds with broad inflated ridges.

Flowering and fruiting: September and November to April, after heavy rains.

Distribution and habitat: Southern Oman: Dhofar, in the dry gravel plains and wadi beds, and in wadis in the dry zone, with scattered *Boswellia*, *Commiphora*, *Ziziphus*, *Acacia*,

Altitude: 500–600 m. A regional endemic, localized and rare in Oman, but widespread in the Mahra region in SE Yemen.

Distribution map & Illustration: 709.

4. ***Schweinfurthia pterosperma*** (A.Rich.) A.Braun, [Sitzungs-Ber. Ges. Naturf. Freunde Berlin 1866: (9): 24 (1866), nom nud] Monatsber. Königl. Preuss. Akad. Wiss. Berlin 1866 872 (1867).
Basionym: Antirrhinum pterospermum A.Rich. (1851).

Description: Annual herb with a woody base or perennial. Stems branching narrowly divaricate, erect, up to 45 cm, somewhat fleshy towards the tip, glabrescent. Leaves 8–40 × 2–12 mm, oblong-ovate to narrow oblanceolate, glabrous, obtuse to acute, base gradually tapering into the petiole, 3–10 mm. Flowers axillary in lax racemes; pedicels 3–13 mm, becoming recurved. Calyx lobes unequal, ovate, acute, somewhat scarious; upper lobe 3–5 mm; lower lobe 3–4 mm; median lobes 2.5–3.5 mm. Corolla white with a pink throat, 6–8 mm, upper lip 2-fid, lower lip 3-fid with a conspicuous yellow palate with purplish glandular hairs. Stamens 4. Capsule 5–6 mm, globose, glabrous, with unequal locules. Seeds with wing-like ridges.

Flowering and fruiting: August.

Distribution and habitat: Northern Oman, on sandy soils in coastal areas; not common. *Altitude*: ± 20 m. Distributed in SW Pakistan (Baluchistan), Eritrea, Djibouti, Ethiopia, Somalia and SW Arabian Peninsula. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 710a.

Notes: The record is based on single collection made in 1982 from Al Ashkara on the eastern coast of Oman. Over the last decade Al Ashkara has developed from a small fishing village to a town and several species collected in this area, including this one, have not been collected in recent years. This species is assessed here as Critically Threatened [CR A4 (c, d)] on the Natonal Red List; more collection data will be necessary to fully assess its status.

5. ***Schweinfurthia latifolia*** Baker, Bull. Misc. Inform. Kew 1894: 338, nomen, et in Hook. Icon. pl. 24: t. 2362 (1895).
Type: Yemen, Hadhramaut, Mokalla, 21.xii.1893, *Lunt* 58 (holotype K).
Synonym: *Schweinfurthia pterosperma* (A.Rich.) A.Braun var. *latifolia* (Baker) Rothm. Feddes Repert., 52: 32 (1943), pro parte.

Description: Perennial herb with a woody base. Stems branching from base, erect, up to 45 cm, glabrescent, young shoots densely glandular-hairy. Leaves 23–43 × 15–35 mm, ovate to ovate-orbicular, glabrous, apex obtuse to acute or apiculate, base cordate to truncate; petiole 4–8 mm. Flowers axillary in lax racemes; pedicel 8–12 mm, up to 16 mm in fruit, becoming recurved. Corolla pale yellow with a pale purple upper lip, 20–30 mm. Calyx

lobes unequal, thickened at margins, densely glandular-pubescent; upper lobe 15–18 mm, broadly ovate to deltoid; lower lobe 12–16 mm, ovate; median lobes 11–14 mm, linear-lanceolate. Stamens 4. Capsule 9–11 mm, globose, glabrous, with unequal locules. Seeds tuberculate.

Flowering and fruiting: August.

Distribution and habitat: Southern Oman, Dhofar, on moist sandy-silty soils; not common. Altitude: 450–850 m. A regional endemic elsewhere in the Arabian Peninsula found in Yemen (Hadramaut).

Distribution map & Illustration: 710b.

Notes: An uncommon species and very restricted in its distribution. Assessed as Critically Endangered [CR C2 (b), D1] on the National Red List, threatened by development and road construction in the area.

6. ***Schweinfurthia pedicellata*** (T.Anderson) Balf., Benth. & Hook.f., Gen. Pl. 2: 934 (1876). Type: Yemen, Aden, *J.D. Hooker* 87 (lectotype K).
Basionym: *Anarrhinum pedicellatum* T.Anderson (1861).

Description: Erect annual herb 20–40 cm high, branching profusely. Leaves opposite below, alternate above, 10–40 × 0.5–3(–5) mm, linear, somewhat fleshy, glabrous, obtuse, base gradually tapering into the petiole, ± 3–12 mm. Flowers solitary; pedicels filiform, 8–14 mm, only the upper part recurving. Calyx lobes unequal, 3–5 mm long, the upper longest, ovate-lanceolate, acute. Corolla pale lilac or pink with yellow on the palate, ± 7 mm, upper lip 2-fid, lower lip 3-fid with a prominent palate and with central lobe overlapping the laterals. Stamens 4. Capsule nodding, with unequal locules, globose, 6 mm in diameter, dehiscing by irregular basal pore in the large locule. Seeds ridged.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, on rocky coastal slopes. *Altitude*: 200–1000 m. Distributed in Pakistan, (Sind), Egypt, Ethiopia, Somalia, and the Comoro Islands. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen (S); also found on Soqotra.

Distribution map & Illustration: 711.

Notes: Rare in Oman, record based on a single collection from Dhofar in dry areas, without precise locality, *McLeish* 1532 (E).

2. **Misopates** Raf.
A small genus of 3 species extending from Cape Verde to NW India and from Europe to South Africa.

Misopates orontium (L.) Raf., Autikon Botanikon: 158 (1840).
Basionym: *Antirrhinum orontium* L. (1753).

Description: Annual herb to 40 cm high. Stem erect, simple or branched, ± pubescent or glabrescent. Leaves opposite, in the upper part of stem alternate, 8–20 cm × 2–3 mm, linear to narrowly lanceolate, entire, glabrous or slightly ciliate, acute to obtuse, base gradually narrowing into the petiole. Flowers in terminal racemes, few- to many-flowered; bracts leaf-like, longer than the flowers; pedicels 1–2 mm, glandular-hairy. Calyx 5-lobed, lobes 8–10 mm, linear, sparsely hispid and glandular-hairy; calyx lengthening in fruit. Corolla 2-lipped, saccate at the base, 8–20 mm long, pale pink or white with purple veins, upper lip 2-lobed, lower lip 3-lobed produced into a large palate; hairs on the lip yellow. Capsule 6–12 mm, obliquely ovoid, hispid, dehiscing by apical pores.

Flowering and fruiting: March to May.

Distribution and habitat: Northern Oman, including Musandam, on soil on rock ledges, amongst boulders, in shade of trees with other annuals, in cultivated, disturbed and open places and beside roads. *Altitude*: 50–1800 m. Widespread in the mountains of eastern tropical Africa, North and South Africa, Europe, Arabia and parts of Asia. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 712.

3. **Nanorrhinum** Betsche

Ten species distributed in the tropical and subtropical regions of Africa and Asia.

1. Corolla including spur 17–24 mm ..... 3. **N. heterophyllum**
   Corolla including spur 3.5–6 mm 2
2. Perennial herb; pedicels < 20 mm long ..... 1. **N ramosissimum**
   Annual herb; pedicels > 20 cm long ..... 2. **N. hastatum**

1. ***Nanorrhinum ramosissimum*** (Wall.) Betsche, Cour. Forsch. Inst. Senckenberg 71: 132 (1984).

Basionym: *Linaria ramosissima* Wall. (1931) nom. illegit. *Synonyms*: *Kickxia ramosissima* (Wall.) Janchen (1933); *K. chasmophytica* Wendelbo (1980).

Description: Perennial herb, much-branched with slender, prostrate or decumbent branches, hanging against cliffs or walls, up to 60 cm long, glabrous or glandular to sparsely pubescent. Leaves usually alternate; basal leaves 5–7 × 2–4 mm, ovate to oblong-ovate to elliptic, usually entire; upper leaves 4–10 × 2–5 mm ovate, acute to obtuse, entire, usually hastate, truncate or cordate at the base, usually decreasing in size along the stems, well spaced, pubescent; petioles 1–6 mm long, patent. Flowers axillary; pedicels filiform, much longer than most of the leaves, < 20 mm. Calyx deeply 5-lobed, lobes 3–5 mm, lanceolate with narrow scarious margins, glabrous. Corolla 2-lipped extending at the base into a long spur, pale yellow, violet on the inside of the upper lip and near the base of the lower lip, 3.5–6 mm long including the spur; palate pubescent to glabrous; spur slender, longer than the corolla tube. Stamens 4, anthers ciliate. Capsule 2.5–5 mm, globose to subglobose.

Flowering and fruiting: April to June.

Distribution and habitat: Northern Oman, at higher altitudes on the Hajar mountains, on rocky and stony hillsides, and in wadis. *Altitude*: 1000–2000 m. Widespread from Myanmar westwards through India, western China, Pakistan, Afghanistan, Iran and Arabia to NE Africa (Sudan, Ethiopia, Somalia, northern Kenya). Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 713.

Notes: A species variable in pubescence and size of leaves.

2. ***Nanorrhinum hastatum*** (Benth.) Ghebrehiwet, Nord. J. Bot. 20(6): 677 (2000).
Basionym: *Linaria hastata* R.Br. ex Benth. (1846).

Description: Annual herb, simple or branched at base, with slender, erect, prostrate or decumbent and trailing branches, hanging against cliffs or walls, up to 60 cm long, glabrous or glandular to sparsely pubescent. Leaves basal and cauline; basal leaves few, falling soon, 10 × 6 mm, ovate to ovate-lanceolate; cauline leaves 7–22 × 2–4 mm, decreasing in size upwards, lanceolate to linear-lanceolate, entire, acute, hastate to sagittate or the upper with attenuate base, glabrous to ± pubescent; petioles 1–3 mm, slender. Flowers solitary, axillary, throughout the length of the stems; pedicels 20–30 mm, filiform, sometimes reddish, glabrous. Calyx somewhat campanulate, deeply 5-lobed, lobes 3–4 mm, lanceolate with narrow scarious margins, glabrous. Corolla 2-lipped extending at the base into a spur, yellow, ± 3.5 mm long including the spur; palate lanate; spur shorter than rest of the corolla. Stamens 4, filaments sparsely villous. Capsule 2.5–3 mm, globose to ovoid, pale green.

Flowering and fruiting: February to April; September

Distribution and habitat: Northern and southern Oman, including Musandam, in stony and gravely wadis, abandoned cultivations, hillsides and woodland, and in soil pockets in rock crevices. *Altitude*: 30–1000 m. Distributed in NE Africa (Eritrea, Ethiopia, Sudan, Somalia). Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 714.

Notes: A species variable in its pubescence and size of leaves, but fairly constant in these characters in Oman. I have strictly followed Ghebrehiwet's treatment in separation of *Nanorrhinum ramosissimum* and *N. hastatum* and note that the Oman material I have seen, both from northern Oman and Dhofar is identifiable to *N. hastatum*. *Miller* 6084 from Dhofar is cited under both *Nanorrhinum ramosissimum* and *N. hastatum* (Ghebrehiwet, op.cit.); it is *N. hastatum*.

3. ***Nanorrhinum heterophyllum*** (Schousb.) Ghebrehiwet, Nord. J. Bot. 20(6): 677 (2000).
Basionym: *Antirrhinum heterophyllum* Schousb. (1800). *Synonyms*: *Kickxia heterophyl-*

la (Schousb.) Dandy (1956); *K. garaica* D.A.Sutton (1988). Type: Oman, Dhofar, *Miller* 2505 (holotype E; isotypes BM, K).

Description: Perennial herb up to 25 cm. Stems ± woody at base, branched, ascending, slender and spinescent above, scabrid to velutinous, sometimes glandular below. Basal leaves falling soon, (2–)5–12 × (1.5–)2.5–8 mm, ovate to oblong-elliptic, entire, apex obtuse, base rounded; upper leaves 5–12 × 2–8 mm, decreasing in size upwards, deltate to lanceolate, sometimes linear, entire to shallow dentate, acute, base sagittate to hastate; petiole 1–8 mm. Flowers axillary, present all along the stem on reddish, slender, stout Pedicels 10–30 mm. Calyx 5-lobed, lobes 3–5 mm, narrow ovate with scarious margins, glandular-pubescent. Corolla 2-lipped, 17–24 mm long including spur, greenish-yellow, the lower lip darker yellow, occasionally the upper lip tinged red or purplish, glandular-pubescent, lower lip white-woolly inside; tube 5–8 mm; spur 13–16 mm, straight, glandular. Stamens 4; filaments hairy. Capsule 3–4 mm, oblong-ovoid, sparsely glandular.

Flowering and fruiting: May; September, October.

Distribution and habitat: Southern Oman, Dhofar, on plateau, dry hill slopes on the eastern coast, dry north-facing wadis, open desert, sandy depressions and sand and gravely areas. *Altitude*: 0–1000 m. Distributed from the Canary Islands and Cape Verde Peninsula to northern Africa and NE Africa and the Arabian Peninsula. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 715.

Notes: A variable species with some collections showing another form of this taxon. Miller (op. cit., 262) records an open twiggy shrub found on the dry hills bordering the coast east of Mirbat and the dry northern slopes of the escarpment hills. This has purple to pink flowers with a yellowish spur. He suggests that this may be a distinct taxon. A collection (made by Th. Bent, dated 1895) from Mirbat coast also shows small (3–4 mm) linear leaves and pink flowers. Ghebrehiwet (op. cit., p. 685) notes that a collection from southern Yemen (Thulin et al. 8135) "with stout rigid stems and a few minute subsessile linear leaves" when grown from seed "showed slender flexuous stems with distinct basal leaves, and with many hastate or sagittate cauline leaves with distinct petioles". I am following Ghebrehiwet on the circumscription of *N. heterophyllum* (see Ghebrehiwet, op. cit., p. 684) and include this form under *N. heterophyllum*.

4. **Linaria** Mill.

About 150 species distributed from Eurasia south to N Africa, Arabia and India; introduced and naturalized elsewhere in temperate regions.

Linaria simplex Desf., Tab. Ecole Bot.: 65 (1804).

Synonyms: *Antirrhinum simplex* Willd. (1800); *Linaria simplex* (Willd.) DC. (1805), nom illeg.

Description: Annual herb to 15 cm. Stem usually simple, erect, glabrous except the sparsely glandular- pubescent inflorescence. Leaves sessile, in whorls of 3–5 below, alternate above, 20–22 × 1 mm, linear, entire with inrolled margins. Flowers in terminal clusters of 2–3 flowers opening one at a time [in the Oman material seen, not with elongate racemes]; bracts ± 4 mm, linear; pedicels ± 1 mm, sparsely glandular. Calyx dark green, deeply 5-lobed almost to base, lobes 2–5 mm, oblong to spatulate, glandular-pubescent. Corolla yellow with violet veins, 2-lipped, ± 5 mm; tube ± 2.5 mm; spur ± 3 mm, straight. Capsule 5–5.5 mm, globose, glabrous, light green.

Flowering and fruiting: February.

Distribution and habitat: Northern Oman, and Musandam, in the foothills of the Hajar mountains, in small pockets of soil amongst stones on hill slopes and wadi banks. *Altitude*: 800–1000 m. Distributed in S Europe, N Africa and SW Asia. Elsewhere in the Arabian Peninsula distributed in Saudi Arabia, UAE.

Distribution map & Illustration: 716.

Notes: *Linaria micrantha* is likely to be found in Oman, but all the material I have seen so far belongs to *L. simplex*. *L. micrantha* can be distinguished by its wider leaves (2–3 mm) and larger lilac-blue flowers. It is found in the Mediterranean region, southern Portugal, Iraq and Egypt. In Arabia it is found in Saudi Arabia and Jordan.

5. **Verbascum**

About 360 species distributed from NE Africa west to Europe and eastwards to India, with the centre of diversity presnt in Turkey, Iraq and Iran.

Rhabdotosperma Hartl (1977) is recognized as a separate genus differing from *Verbascum* on lack of accessory flowers in the inflorescence and seeds with longitudinal rather than pitted seeds. I am including *Rhabdotosperma* in *Verbascum* in this flora, but following Hartl, *V. akdarense* would fall under *Rhabdotosperma*.

1 Plant pubescent and glandular; flowers solitary; pedicels 10–20 mm ... 3. **V. akdarense**
Entire plant densely stellate tomentose with or without glandular hairs; flowers in axillary clusters; pedicels up to 6 mm 2

2. Glandular hairs absent; basal leaves not lobed; hairs on filaments white ..... 1. **V. sinaiticum**
Glandular hairs present; basal leaves lobed; hairs on filament purple ... 2. **V. omanense**

1. ***Verbascum sinaiticum*** Benth. in DC., Prodr. 10: 236 (1846).

Synonym: *Verbascum cedreti* Boiss. (1853).

Description: Biennial herb, up to 2.8 m tall. Stems erect, branched, densely white tomentose with stellate hairs, glandular hairs absent. Basal leaves forming a rosette, cauline alternate, grey-green; basal leaves large, up to 35 × 14 cm, oblong to obovate to oblong-ovate, margins irregularly large dentate to entire, apex obtuse, base cuneate into the petiole up to

8 cm; cauline leaves sessile, 20–60 × 12–20 mm, ovate, cordate. Flowers in 2–5-flowered axillary clusters, shortly to pedicellate, in branched lax cymes; pedicels up to 6 mm in fruit; bracts ± 4 × 2 mm, ovate. Calyx 5-lobed, lobes 3–5 mm, oblong, acute, densely stellate tomentose. Corolla yellow, 20 mm across, 5-lobed, lobes 8–9 mm, the upper two slightly larger, rounded, glandular and hairy outside. Stamens 5; filaments orange with white-woolly hairs; anthers with confluent cells, yellow with purple connective. Capsule longer than the calyx, stellate tomentose.

Flowering and fruiting: December to March.

Distribution and habitat: Northern Oman, in the foothills of the mountains, wadi beds, plantations, beside roads, waste and disturbed habitats. *Altitude*: 250–700 m. Distributed from Somalia, westwards through Arabia to Iraq and northwards to Pakistan and Afghanistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 717.

Notes: Originally described from Lebanon, a widespread species, common in Oman and UAE.

2. ***Verbascum omanense*** Hub.-Mor., Candollea 39(1): 320 (1984).
Type: Northern Oman, Batinah, Hibra, 160 m, 2 Mar. 1980, *Edmondson* 3203 (holotype E, isotype E, ON).

Description: Biennial herb, up to 1 m tall. Stems erect, branched, white tomentose with stellate and glandular hairs, especially in the inflorescence. Basal leaves forming a rosette, cauline alternate, grey-green; leaves 30–90(–150) × 15–40(–60) mm, oblong to oblong-ovate, margins dentate to irregularly lobed to entire, apex obtuse, base irregularly lobed or sometimes entire; petiole up to 80 mm; cauline leaves sessile, dentate to entire. Flowers in 2–5-flowered axillary clusters, shortly to pedicellate, in branched lax cymes, spreading; pedicels up to 6 mm in fruit; bracts ± 3 × 2 mm, ovate. Calyx 5-lobed, lobes 3–4(–5) mm, oblong, acute, densely stellate tomentose. Corolla yellow, ± 15 mm across, 5-lobed, lobes 7–9(–11) mm, the upper two slightly larger, rounded, glandular and hairy outside. Stamens 5, filaments orange with purple woolly hairs, white near the anthers, anthers with confluent cells. Capsule longer than the calyx, stellate-tomentose, with the persistent style.

Flowering and fruiting: December to April.

Distribution and habitat: Northern Oman, in the foothills of the mountains, edges of cultivation, beside roads, and in disturbed habitats. *Altitude*: 150–800 m. Regionally endemic to northern Oman and UAE.

Distribution map & Illustration: 718.

Notes: This species is very similar to and sympatric with *V. smaitecum*, but is distinguished by its smaller, usually lobed basal leaves, and a laxer, less rigid inflorescence. Endemic to

the foothills and lower altitudes of the Western and Eastern Hajar mountains and extending to the Hatta hills in the UAE.

3. ***Verbascum akdarense*** (Murb.) Hub.-Mor., Bauhinia 5(1): 10 (1973).
Synonym: Celsia akdarensis Murb. (1925).

Description: Biennial or annual herb, up to 30 cm. Stems erect, sparsely branched, pubescent and glandular. Leaves mostly forming a basal rosette, vivid green, 20–140 × 10–50 mm, oblanceolate, deeply lobed at the base, margins irregularly dentate, apex obtuse. Flowers solitary, in terminal and simple or branched racemes; pedicels slender, 10–20 mm, sparsely glandular; bracts 3–4 mm, lanceolate. Calyx 5-lobed, lobes ± 3 mm, oblong, acute, glandular. Corolla yellow, 5-lobed, lobes 4–5 mm, the upper two slightly larger, oblong, ± glandular outside. Stamens 5; filaments with white-woolly hairs; anthers with confluent cells, yellow. Capsule [immature] about long as the calyx, glabrous, style persisting.

Flowering and fruiting: March to April.

Distribution and habitat: Northern Oman, on the mountains, on rocky slopes and mountain sides, amongst rocks, and in crevices; also recorded from the Eastern Hajar mountains on Jebal Bani Jabir. *Altitude*: 400–1800 m. A regional endemic found mainly on the northern Oman mountain range and extending to the UAE. Not uncommon.

Distribution map & Illustration: 719.

6. **Scrophularia** L.
About 120 species distributed from Eurasia south to Arabia, Himalaya, N Africa to Ethiopia and Somalia, Canada and USA; introduced to the Caribbean.

Plant glandular-pubescent; leaves yellowish-green, ovate to ovate-elliptic with a cuneate to cordate base, margins serrate; capsule ovoid, beaked ..... 1. **S. arguta**
Plant glabrous; leaves dark green, glossy, in outline oblanceolate with a tapering base and irregularly crenate or with deeply lobed margins; capsule globose ..... 2. **S. desertii**

1. ***Scrophularia arguta*** Sol. in Ait., Hort. Kew. I, ii 342 (1789)

Description: Annual herb. Stem erect up to 40 cm, angular, yellowish-green to sometimes reddish-brown, glandular-pubescent. Leaves opposite, 12–40 × 6–30 mm, ovate to ovate-elliptic, base cuneate to cordate, apex obtuse, margins serrate, yellowish-green, glabrous or sparsely hairy, petiole 4–10 mm, pubescent. Flowers in axillary cymes of 3–5 flowers; bracts as leaves but sessile and smaller. Pedicle 4–10 mm (longest in fruit). Calyx deeply 5-lobed, lobes 2.5–3 mm, triangular with narrow hyaline margins, glandular at base, less so at apex. Corolla red to reddish-purple, bilabiate, ± 4 mm; tube short; upper lip 2-lobed, lower 3-lobed. Stamens 4, orbicular scale-like staminode present, all included. Capsule 5–5.5 mm, ovoid, glabrous, covered by the persistent beak-like calyx.

Flowering and fruiting: February, March in N Oman; September, October in S Oman.

Distribution and habitat: Northern Oman, including Musandam, and Southern Oman, Dhofar, in damp and shaded locations, and stony wadi bottoms. *Altitude*: 200–900 m. Distributed in North and North East Africa (Egypt, Djibouti, Eritrea, Ethiopia, Somalia), Macaronesia, S Spain, Madagascar. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 720.

Notes: A short-lived annual, common on the mountains and wadis.

2. ***Scrophularia desertii*** Del., Fl. Eg. 240, t. 33, (1813–1814).

Description: Perennial herb, with annual stems many from a woody base, erect, up to 60 cm, green to sometimes reddish-brown, glabrous. Leaves opposite, on the lower parts of the stem, 15–35 long, oblanceolate in outline, base tapering into the petiole, margins irregularly crenate or pinnatilobed, dark green and glossy, glabrous; petiole 4–10 mm. Flowers in leafless terminal cymes, spreading, many-flowered; bracts as leaves but sessile and scale-like; pedicle ± 4–6 mm. Calyx deeply 5-lobed, lobes 1.5–2 mm, oblong with hyaline margins, glabrous. Corolla maroon to reddish-purple, bilabiate, ± 5 mm; tube short; upper lip 2-lobed, lower 3-lobed. Staminode ovate; stamens exserted. Capsule ± 4 mm, ± 2-lobed, globose with a fine hair-like mucro at apex, glabrous.

Flowering and fruiting: February/March.

Distribution and habitat: Northern Oman, on the lower slopes and wadis of the Hajar mountains. *Altitude*: 200–800 m. Distributed in Jordan, Palestine. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 721.

Notes: An uncommon plant, found at much lower altitudes than reported for Yemen (in Yemen found from 2200 m). Common in the northern part of the Hajar mountains in northern Emirates.

7. **Camptoloma** Benth.
Urbania Vatke
Three species, one on the Canary Islands, one in Angola and Namibia and one in Somalia and SW Arabia.

Camptoloma lyperiiflorum (Vatke) Hilliard, Edinb. J. Bot. 48(3): 341 (1991).
Basionym: *Urbania lyperiiflorum* Vatke (1875) as "lyperiaeflora". *Synonym*: *Camptoloma villosa* Balf.f. (1884).

Description: Perennial herb to 40 cm. Stems branched, whitish. Whole plant covered in long glandular hairs. Leaves pale green, soapy to touch, 12–35 × 18–35 mm, suborbicular, base cordate, apex rounded, margins dentate, petiole 10–40 mm. Flowers 1(–2) in the upper axils of leaves, 5–6 mm across; pedicels ± 20 mm. Calyx deeply 5-lobed; lobes 5–7 mm,

narrow obovate to oblong. Corolla white to cream with red to purple streaks, 2-lipped; tube 7–8 mm, glabrous inside; limb with ± equal lobes. Stamens 4; filaments papillose; anthers confluent. Capsule 5–8 mm, ovoid, beaked, septicidal.

Flowering and fruiting: January; October.

Distribution and habitat: Al Halaniyat Islands, on the main Al Halaniyat Island, amongst stones and boulders on slopes and on beach; not yet recorded from mainland Oman, but expected to occur on the eastern coast of Dhofar. *Altitude*: ± 10 m. Distributed in Somalia. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration: 722.

8. **Lindenbergia** Lehm.

Omania S.Moore

Twelve species distributed from N Africa south to Kenya, tropical Arabia, Pakistan and India to S China and Thailand and the Philippines.

1. Leaves with entire margins ..... 3. **L. arabica**
   Leaves with serrate-dentate margins 2
2. Raised glands present on lower lip of corolla; capsule oblong, glabrous ... 1. **L. indica**
   Glands absent on lower lip of corolla; capsule globose, densely pilose ... 2. **L. muraria**

1. ***Lindenbergia indica*** (L.)Vatke., Oesterr. Bot. Z. 25: 10 (1875).

Basionym: *Dodartia indica* L. (1753). *Synonym*: *Linderbergia fruticosa* Benth. (1846). Type: Oman, Muscat area, *Archer Lloyd* 5104 (holotype K; isotypes FI, FI-WEBB, P, W)

Description: Annual or perennial herb or subshrub to 50 cm. Stems usually branched, erect to ascending or prostrate to pendent, sparsely to densely pilose with glandular and eglandular hairs. Leaves opposite, 1.5–35 × 1–25 mm, lanceolate to ovate to suborbicular, base shortly attenuate, apex acute to obtuse, margins serrate-dentate, pilose on both surfaces; petiole 1–20 mm. Flowers axillary, solitary; bracts as leaves but smaller; pedicels 1–6 mm. Calyx 5-lobed, 3–8 mm, lobed to half the length, lobes ovate, pilose with glandular and eglandular hairs. Corolla yellow to orange-yellow, 2-lipped, reddish on the upper lip, 8–18 mm, pilose with glandular and eglandular hairs on the outside; tube 4–9 mm, pilose; upper lip 2-lobed, lobes ovate, margins revolute; lower lip 3-lobed, lobes obovate, medially pilose, ± spreading, the lobes with raised glands. Stamens 4; filaments pilose at base; thecae stipitate. Capsule 4–8 mm, ovoid, beaked, glabrous to sparsely pilose.

Flowering and fruiting: March, April in northern Oman; September, October in southern Oman.

Distribution and habitat: Northern, Central and Southern Oman, Masirah and Al Hallaniyat Islands; in the foothills and plains the northern and southern mountains, on limestone cliffs in seepages and cliff faces in ravines, on wet shaded rocks, and on tree trunks; not common but widespread in Oman. *Altitude*: 0–1700 m. Widespread from Egypt, Sudan,

Eritrea, Ethiopia, Somalia, northern Kenya, through the Middle East to Pakistan, India and Bangladesh. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 723.

Notes: A species variable in size of stem, leaves and flowers and occupying many different habitats in Oman. Plants from the Sahil al Jazir coast, Shuaimiyah, Ras Madrakah are smaller, with small, densely pilose stems and leaves. Superficially resembling *L. muraria* and often misidentified as that. Clearly distinguished in its almost glabrous ovary, and glabrous oblong capsules, and a glandular lower lip of the corolla.

2. ***Lindenbergia muraria*** (Roxb.) Brühl, J. Dep. Sci. Univ. Calcutta (Bot.) 2: 26 (1920).
Basionym: *Stemodia muraria* Roxb. (1825).

Description: Annual or perennial herb, up to 50 cm. Stems usually branched, erect to ascending, pilose with glandular and eglandular hairs. Leaves opposite, green to dark green often purplish beneath, 4–60 × 2–45 mm, lanceolate to ovate, base shortly attenuate, apex acute to obtuse, margins serrate-dentate, pilose; petiole 1–20 mm. Flowers axillary, solitary; bracts as leaves but smaller; pedicels 1–4 mm. Calyx 5-lobed, 2.5–5 mm, lobed to half the length, lobes ovate, pilose with glandular and eglandular hairs. Corolla pale yellow to orange-yellow, 2-lipped, tube 4–7 mm, pilose; upper lip 2-lobed, lobes rounded; lower lip 3-lobed, galeate, lobes obovate, spreading, with dumb-bell shaped hairs inside. Stamens 4, filaments pilose; thecae stipitate. Capsule 3–5 mm, ovoid, beaked, densely pilose.

Flowering and fruiting: September, October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment hills, along paths and on wet shaded rocks. *Altitude*: 200–350 m. Distributed from Ethiopia, Oman through to India, Bangladesh, Myanmar to Vietnam and China. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 724.

3. ***Lindenbergia arabica*** (S.Moore) Hartl., Oester. Bot. Z. 102: 82 (1955).
Basionym: *Omania arabica* S.Moore (1901). Type: Oman [without precise locality], 1898, *Jayakar* s.n. (lectotype BM).

Description: Small shrub, 30–100 cm. Stems branched, erect to ascending, densely pubescent with eglandular hairs. Leaves 2–7 × 1.5–5 mm, ovate to suborbicular, base shortly attenuate, apex obtuse, margins entire, densely pubescent on both surfaces; petiole 0.5–2 mm. Flowers axillary, solitary in lax racemes; bracts as leaves but smaller; pedicels 2–3 mm. Calyx 5-lobed, 3–9 mm, lobed to half the length, lobes triangular, pubescent outside and pilose with few glandular hairs inside. Corolla yellow with purplish veins and reddish spots on the lower lip, 9–11 mm, 2-lipped; tube 5–6 mm, pubescent; upper lip triangular with revolute margins, apex retuse or 2-toothed; lower lip 3-lobed, lobes obovate, not spreading, sparsely pilose medially inside. Stamens 4, filaments sparsely pilose at the base

with short glandular hairs; thecae stipitate. Capsule 5–6 mm, oblong, shortly pubescent to glabrous.

Flowering and fruiting: November to April.

Distribution and habitat: Northern Oman, in the foothills of the Western Hajar mountains, on rocky hillslopes and wadi banks. *Altitude*: 20–500 m. Endemic to the northern mountains in Oman and eastern hills in the UAE (Wadi Farfar, SE of Fujairah, ± 300 m).

Distribution map & Illustration: 725.

Notes: The lectotype chosen by Hjertson (1995) is one of the two syntypes mentioned in the protologue, *Aucher-Eloy* 5165 and *Jayakar* s.n.

9. **Bacopa** Aublet *nom.conserv.*
About 60 species pantropical in distribution.

Bacopa monnieri (L.) Pennel, Proc. Acad. Nat. Sci. Philad. 28: 94 (1946).
Basionym: *Lysimachia monnieri* L. (1756).

Description: Perennial herbs. Stems up to 40 cm high, branched, ascending to prostrate and creeping, rooting at nodes, 4-angled, glabrous. Leaves sessile, 8–20 × 3–6 mm, oblong to spatulate, apex obtuse, margins entire. Flowers solitary in the axils of leaves; pedicels 5–30 mm long. Bracteoles ± 5 mm, ovate, present below the calyx. Calyx 5-lobed to the base, ± 5 mm, glabrous, the outer 3 lobes broadly ovate, with the upper lobe largest; 2 lateral lobes smallest, lanceolate. Corolla blue-violet to white, subrotate; tube ± 5 mm, upper lip emarginate, 3–5 mm, lower lip equally 3-lobed. Stamens 4, 2 long and 2 short. Capsule ± 4 mm, ovoid, glabrous.

Flowering and fruiting: More or less throughout the year.

Distribution and habitat: Northern and Southern Oman, in mud on margins of permanent water pools and streams, and edges of cultivations. *Altitude*: 20–1500 m. Pantropical in distribution. Elsewhere in the Arabian Peninsula known from Bahrain, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 726.

10. **Craterostigma** Hochst.
About 15 species mainly in tropical South Africa, extending to Madagascar, Arabia and India.

Craterostigma pumilum Hochst., Flora 1841: 24 (2): 67 (1841).

Description: Perennial herbs, rosetted up to 7 cm. Stem very reduced and covered in old leaf-bases, hirsute to ± glabrous, with many reddish roots. Leaves sessile, lying flat on the ground, 2–4 × 1–2 cm, linear-lanceolate to broadly ovate to ovate-elliptic, margins entire, obtuse to acute or shortly acuminate, base narrowing into a short, broad petiole, densely

pubescent beneath, glabrous and smooth above, margins ciliate, 5-veined. Inflorescences shortly racemose, arising from the centre of the rosette, ± sessile; bracts lanceolate, up to 1 cm long, ciliate; pedicels 2–3 cm long, pilose. Calyx 3–5 mm, lengthening in fruit, tubular, 5-ribbed; teeth 5, subequal, acuminate. Corolla blue or purple with yellow throat, ± 15 mm, upper lip hooded, entire or emarginate, lower lip with 3 broad lobes, spreading. Stamens 4; filaments with a yellow appendage at the base and sharply angled about the middle. Capsule as long as or slightly longer than the calyx, broadly ovoid.

Flowering and fruiting: October.

Distribution and habitat: Southern Oman, Dhofar, in sandy depressions on the summit plateau. *Altitude*: ± 1800 m. Distributed in Somalia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 727.

Notes: The species is rare in Oman and has been only collected once in October 1999 after heavy rain, in a sandy depression on the summit plateau on Jebal Semhan. Also recorded to be rare in Yemen by Wood (Fl. Yemen: 1997).

11. **Campylanthus** Roth

Fifteen species distributed in northeast tropical Africa, southern Arabia, Pakistan, also Canary Islands and Cape Verde Islands.

1. Leaves broadly obovate, succulent ..... 1. **C. sedoides**
   Leaves never succulent 2
2. Flowers pink to pinkish-brown or yellow-brown; corolla tube 14–18 mm long 3
   Flowers purple, reddish, blue or white; corolla tube to 10 mm long 4
3. Stems aphyllous, erect, pubescent to glabrous, flowers brownish-yellow; calyx ciliate; corolla tube ± 15 mm ..... 3. **C. antonii**
   Stems leafy, prostrate to ascending, hirsute to villous, flowers pink to pinkish-brown; calyx villous to hirsute; corolla tube 14–18mm ..... 2. **C. chascaniflorus**
4. Undershrub to 25 cm; stems and leaves hirsute to villous; corolla tube bent at level of calyx ..... 5. **C. mirandae**
   Small shrub to 1 m; stems and leaves glabrescent; corolla tube bent in the middle to lower third 5
5. Pedicels ± 1 mm ..... 4. **C. pungens**
   Pedicels 1.5–3.5 mm ..... 6. **C. hajarensis**

1. ***Campylanthus sedoides*** A.G.Mill., Notes R.B.G. Edinb. 38: 382, fig. 2a & 5Aa–e (1980).

Type: Oman, Dhofar, Shuwamiyah, 14 Oct. 1979, 600 m, *Miller* 2727 (holotype E; isotype K).

Vernacular name: gunerain.

Description: Subshrub to 20 cm. Stems grey-green, procumbent, bark somewhat peeling,

glabrescent. Leaves succulent, sessile, 1.5–8 × 1.5–4 mm, broadly ovate to obovate or spatulate, obtuse, hirsute. Flowers 2–4, axillary, with short pedicels; bracts and bracteoles up to 3 mm, narrow, hirsute. Calyx 5-lobed; lobes 2–5 mm, narrow elliptic. Corolla pink to reddish-brown; tube 6–9 mm, bent just above the calyx, hirsute outside; lobes ± 3 mm, broadly ovate, acute. Stamens 2; filaments glabrous; anthers confluent. Capsule 3–5 mm, broadly obovoid, brown.

Flowering and fruiting: February to May; September, October.

Distribution and habitat: Southern and Central Oman, from the eastern coastal areas, on sandy beaches with sparse vegetation, and on adjoining open gravel plains, from Shuwamiyah to Sawqirah on the Sahil Jazir coast; also recorded from Bar al Hikman and Masirah Island. *Altitude*: 0–600 m. Endemic to Oman.

Distribution map & Illustration: 728.

2. ***Campylanthus chascaniflorus*** A.G.Mill., Notes R.B.G. Edinb. 38: 380, fig. 2e & 5Ba–d (1980).
Type: Oman, Dhofar, Ras Hamar, 28 Sept. 1979, *Miller* 2312 (holotype E).

Description: Woody based herb with annual stems, 25 cm. Stems grey-green, branching from the base, prostrate to ascending, hirsute to villous. Leaves sessile, 2–18 × 5–7 mm, obovate to elliptic, obtuse to acute, hirsute to sometimes villous. Flowers in one-sided racemes; pedicels 2–6 mm; bracts and bracteoles up to 4 mm, narrow, hirsute. Calyx 5-lobed, lobes ± 1 mm, narrow ovate with narrow scarious margins, hirsute to villous. Corolla pink to pinkish-brown; tube 14–18 mm, bent in the middle, glabrous outside; lobes 4–7 mm, oblong to narrow ovate, acute, glabrous. Stamens 2; filaments glabrous; anthers confluent. Capsule 4–5.5 mm, globose, brown.

Flowering and fruiting: September, October.

Distribution and habitat: Southern Oman, Dhofar, rocky slopes and coastal cliffs, wadi beds with *Commiphora*, *Ziziphus leuconeurmis*, *Boswellia sacra*. *Altitude*: 0–100 m. Endemic to Dhofar; not uncommon.

Distribution map & Illustration: 729.

3. ***Campylanthus antonii*** Thulin, Nord. J. Bot. 15(2): 191–192 (1995).
Type: Yemen, Mahrah region, 13 km from Sayhut along road to Qishn, 16 Oct. 1992, *Thulin, Eriksson, Gifri & Langström* 8407 (holotype UPS; isotype K).

Description: Virgate undershrub, ± 50 cm tall. Stems grey-green, aphyllous, erect, obscurely ribbed, pubescent below, glabrous above. Leaves alternate, sessile, 1.5–2.5 × 0.5–0.8 mm, linear to narrow elliptic, minutely pubescent or ciliate. Flowers in terminal 5–13-flowered racemes; pedicels ± 3 mm. Bracts and bracteoles ± 1 mm, ciliate. Calyx 5-lobed, lobes ± 1 mm, narrowly ovate, acute, ciliate. Corolla brownish-yellow; tube ± 15 mm, doubly bent in the upper third, glabrous outside, hairy inside; lobes ± 4 mm, linear, acute, glabrous,

recurved. Stamens 2; filaments glabrous; anthers confluent. Capsule ± 4 long, globose, brown.

Flowering and fruiting: October.

Distribution and habitat: Southern Oman, Dhofar, rocky slopes. *Altitude*: ± 100 m. A regional endemic found in the Mahrah region in SE Yemen and in the bordering areas and Jebal Qamar in southwest Dhofar.

Distribution map & Illustration: 730.

4. ***Campylanthus pungens*** O.Schwartz, Mitt. Inst. Bot. Hamburg 10: 245 (1939).
Type: Yemen, Hadramaut, *Wissmann* 661 (holotype HBG).

Description: Undershrub or small shrub to 1 m. Stems more or less leafless, grey-green, thick, branched, spinescent, glabrous to scabrid at base. Leaves sessile, 1–6 × 0.2–0.5 mm, linear to subulate, acute, glabrous. Flowers in terminal racemes; pedicels ± 1 mm, glabrous; bracts and bracteoles 0.5–1.5 mm, glabrous to ciliate. Calyx 5-lobed, lobes 2–5 mm, linear, acute, ciliate. Corolla purple to reddish-purple to blue or white, glabrous outside; tube 8–10 mm, bent in the lower third part, glabrous outside; lobes 2–4 mm, ovate, acute, glabrous. Stamens 2; filaments glabrous; anthers confluent. Capsule 4–5 mm, globose, reddish-brown.

Flowering and fruiting: September, October.

Distribution and habitat: Southern Oman, Dhofar, on rocky slopes and coastal cliffs, and north facing wadis with *Commiphora*, *Acacia* and *Euphorbia*. *Altitude*: 100–400 m. Endemic to the Arabian Peninsula. Found in Saudi Arabia, Yemen and Oman.

Distribution map & Illustration: 731.

5. ***Campylanthus mirandae*** A.G.Mill., Notes R.B.G. Edinb. 45: 75, fig. 1A–h (1988).
Type: Oman, Dhofar, Jebal Qamar, plateau area of western mountains, on southwards facing stony steps above sea cliffs, Sep. 1984, *Morris* 258 (holotype E).

Description: Small shrub to 25 cm. Stems more or less leafless, grey-green or sometimes purplish-grey, branched, ± spinescent, hirsute to villous. Leaves sessile, 3–7 × ± 1 mm, linear-oblong to subulate, acute, hirsute. Flowers in terminal racemes; pedicels ± 2 mm, shortly hirsute; bracts and bracteoles 1.5–2 mm, hirsute. Calyx 5-lobed; lobes 3.5–4 mm, linear, acute, hirsute. Corolla purple, glabrous outside, tube 8–9 mm, bent about the level of calyx, glabrous outside; lobes ± 4 mm, obovate, acute, glabrous. Stamens 2; filaments glabrous; anthers confluent. Capsule 3–5 mm, globose, brown.

Flowering and fruiting: September, ?October.

Distribution and habitat: Southern Oman, Dhofar, on stony and seaward facing rocky cliffs. *Altitude*: ± 400 m. Endemic to Dhofar.

Distribution map & Illustration: 732.

Notes: Rare in Oman with a very restricted distribution, but not at threat at present.

6. ***Campylanthus hajarensis*** Hjertson, Henrot & Thulin, Nord. J. Bot. 26: 35–37 (2008). Type: Oman, above Ta'ab village, in gorge off the road between the coast & Salma plateau, 20 April 2007, *Henrot* 232 (holotype ON).

Description: Densely branched shrub to 50 cm. Stems grey-green, becoming ± spinescent, glabrous. Leaves few and scattered, sessile, 3–7 × 0.8–1.3 mm, linear narrowly elliptic, acute, glabrous. Flowers up to 5, on short spreading lateral branches; pedicels 1.5–3.5 mm, glabrous; bracts and bracteoles 0.5–1.0 mm, glabrous to sparsely ciliate. Calyx 5-lobed, lobes 3–4 mm, lanceolate to narrowly triangular, acute, glabrous, margin ciliate. Corolla white with yellow throat and yellowish-brown on outside of tube, glabrous outside; tube 10–12 mm, bent near the middle, glabrous outside, retrorsely hairy above and below the stamens inside; lobes 2.5–3.5 mm, narrowly ovate, acute, glabrous. Stamens 2; filaments glabrous; anthers confluent. Capsule 3.0–4.5 mm, globose, laterally compressed, dark brown. Seeds flat, narrowly winged around the margins.

Flowering and fruiting: September, October.

Distribution and habitat: Northern Oman, eastern Hajar mountains, common on slopes of limestone gorges with *Acacia tortilis* and *Euphorbia larica*. *Altitude*: ± 400 m. Endemic and so far known from the type locality.

Distribution map & Illustration: 733.

Notes: This species comes closest to *C. pungens* but differs in its longer pedicels.

12. **Anticharis** Endl.

A genus with 10 species distributed in dry areas from SW Africa to Arabia and India.

Stems sparsely glandular; bracteoles inserted about the middle or below the middle of peduncle ..... 1. **A. arabica**

Stems densely glandular; bracteoles inserted about the middle of pedicels ..... 2. **A. glandulosa**

1. ***Anticharis arabica*** Endl., Nov. Stirp. Dec.: 23 (1839).

Type: Yemen, Mts Sidr & Kasr, Geddae, *Tzschey* 17 & Ferihe, *Schimper* 748 (syntypes M).

Description: Annual herbs, up to 15 cm. Stems erect, simple or sparsely branching, glandular-pubescent throughout. Leaves 10–30 × ± 2 mm, linear-lanceolate, sessile, base attenuate, apex acute, margins entire, sparsely glandular. Flowers solitary in the axils of leaves; pedicels 8–10 mm, with 2 bracteoles inserted about or below the middle of pedicels. Calyx lobed to almost base, lobes ± 3 mm, linear. Corolla blue with a white throat, 8–10 mm, lobes ± 2 mm. Stamens 2; anthers coherent or free. Capsule ± 7 mm, narrow ovoid, exserted, dehiscing into 4 segments.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar in the foothills and plains, in gravelly and stony places. *Altitude*: Distributed in Sudan, Eritrea, Ethiopia, Somalia, northern Kenya. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 734.

2. ***Anticharis glandulosa*** Aschers., Monatsb. Acad. Berl.: 880 (1866) publ. (1867).

Description: Annual herbs, up to 30 cm. Stems branching from the base, spreading, densely glandular hairy; glands stalked, reddish-brown, viscid. Leaves 15–30 × 5–8 mm, ovate to elliptic-lanceolate, sessile, base attenuate, apex acute, margins entire. Flowers 1–2, terminal and axillary; pedicels up to 5 mm with bracteoles inserted about the middle of pedicels. Calyx deeply 5-lobed, lobes , linear. Corolla pale purple-blue, 10-15 mm, tubular, unequally 5-lobed above. Capsule narrow ovoid, exserted, surrounded by the persistent calyx.

Flowering and fruiting: October to April; September to October.

Distribution and habitat: Northern and southern Oman, in the foothills of the mountains, gravel plains, stony wadi beds. Distributed from western India to Iran, and southwards to Somalia. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 735.

Notes: A relatively short-lived annual coming up after rain.

13. **Veronica** L.

About 180 species distributed mainly in temperate regions, also in tropical regions at higher altitudes.

Plant with stems glabrous or very sparsely glandular; leaves with serrulate margins ..... 1. **V. anagalloides**

Plant with pubescent stems; leaves with 2–3 dentations on each margin ..... 2. **V. polita**

1. ***Veronica anagalloides*** Guss., Pl. Rar. 5: t. 3 (1826).

subsp. ***anagalloides***

Synonyms: *Veronica haussknechtii* Boiss. (1879); *V. anagallis-aquatica* L., subsp. *anagalloides* (Guss.) Rouy (1909).

Description: Annual herb up to 25 cm. Stems erect, ± branched, glabrous and very sparsely glandular. Leaves opposite, sessile, 20–50 × 8–16 mm, ovate-elliptic, acute, margins serrulate. Flowers in axillary racemes; bracts 5–6 mm, lanceolate; pedicels ± 3 mm elongating to ±6 mm in fruit, very sparsely glandular. Calyx campanulate, 2–3 mm, lobes 1 mm, triangular, glabrous. Corolla white to blue, 3–5 mm across, slightly longer than the calyx. Capsule ± 3 mm, globose, glabrous.

Flowering and fruiting: September/October.

Distribution and habitat: Southern Oman, Dhofar, in shaded locations, on and amongst rocks. *Altitude*: ± 550 m. Distributed from S Europe, Turkey, Syria, Iraq, Iran, Afghanistan to China, and to Arabia and Egypt. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 736.

Notes: The record in Oman is based on a single collection from Sarfait, near the Yemen border. Not common, but being an annual possibly under-collected.

2. ***Veronica polita*** Fries, Nov. Fl. Suec.: 63 (1819).
Synonyms: *Veronica didyma* auct., *vix* Ten. (1811).

Description: Annual herbs up to 10 cm. Stems ± erect to creeping, reddish, pubescent with long and short hairs. Leaves opposite, petiolate, up to 5 × 4 mm, ovate, obtuse, margins with 2–3 dentations on either side, glabrous to sparsely pubescent. Flowers axillary, nodding; pedicels slender, reddish. Calyx lobed almost to the base, 2–3 mm, lobes ± 1 mm, triangular, glabrous. Corolla white to bluish, 3–5 mm across, as long as or longer than the calyx. Capsule ± 3 mm, 2-lobed, glabrous.

Flowering and fruiting: January.

Distribution and habitat: Northern Oman, in the Western Hajar mountains on the summit plateau, as a weed of cultivation. *Altitude*: ± 2000 m. Distributed from Europe to North and North East Africa, and from Syria to China, Japan, also North and South America. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration: 737.

Notes: The record in Oman is based on a couple of collections from the Saiq plateau, growing in cultivations.

14. **Alectra** Thunb.
About 30 species distributed from tropical Africa to South Africa to Madagascar, tropical Arabia, N India to S China to the Philippines, Mesoamerica and Caribbean to Colombia and Guyana, and Brazil.

Alectra parasitica Hochst. ex A.Rich., Tent. Fl. Abyss. 2: 117 (1850).

Description: Annual herb, parasitic on roots. Stems erect, 6–30 cm, simple or branching from the base, puberulous. Roots orange-yellow. Leaves opposite to alternate, sessile, few on the stem, thick and scale-like, embracing the stem, 4–10 × 2–5 mm, ovate-lanceolate to linear-lanceolate, entire, acute to obtuse, base shortly cuneate, puberulous to hispid on both surfaces. Flowers in terminal racemes, solitary in the axils of leaf-like bracts present in the upper part of the stem; pedicels ± 2 mm; bracts 3–4 mm, linear-lanceolate; bracteoles ± 2 mm, linear. Calyx 5–6 mm, campanulate with 10 distinct nerves, lobes 3–4 mm, triangular, margin thick, puberulous to hispid. Corolla orange with red to purple veins, 4-lobed, about

2× length of calyx, lobes ± equal, rounded. Stamens 4; filaments glabrous. Capsule 4–5 mm, subglobose, glabrous, enveloped by the calyx.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment hills, in shade in *Anogeissus* woodland; common root parasite on *Euphorbia*, *?Cissus*. *Altitude*: 400–600 m. Distributed in tropical east Africa, Somalia, Ethiopia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 738.

15. **Striga** Lour.

A genus with about 40 species distributed in the Old World tropics and subtropics, occasionally introduced in the warmer parts of N America.

Striga is semi-parasitic on roots of grasses, cereal crops and a wide range of other hosts. Of the four species recorded from Oman, *S. asiatica* and *S. densiflora* have each been recorded only once more than a decade ago from local sorghum and millet cultivations. Farming practices have changed drastically over the last 20 years in Oman; millet and sorghum are not widely cultivated anymore. These two species have never been collected since and may not be present there today.

1. Calyx with 10 or more ribs 2
   Calyx with 4 or 5 ribs 3
2. Plant densely hispid; leaves 0.3–2 mm wide; flowers yellow and/or red ..... 4. **S. asiatica**
   Plant not densely hispid; leaves 1–3 mm wide; flowers white ..... 2. **S. angustifolia**
3. Stems usually succulent; a single large haustorium present; leaves reduced to scales; flowers purple ..... 1. **S. gesnerioides**
   Stems not succulent; many small haustoria present; leaves not reduced to scales; flowers white ..... 3. **S. densiflora**

1. ***Striga gesnerioides*** (Willd.) Vatke, Oesterr. Bot. Zeitschr. 25: 11 (1875).

Basionym: *Buchnera gesnerioides* Willd. (1802).

Description: Annual or perennial tufted herb. Stems succulent, square, angular, usually branching from base, reddish-purple, 10–20(–30) cm, drying black. A single large primary haustorium 1–3 cm diameter usually present and abundant adventitious roots from subterranean scales. Leaves scale-like, adpressed to the stem, 5–10 × 2–3 mm, minutely puberulent to almost glabrous; bracts usually the same length and width as calyx, acuminate; bracteoles minute. Flowers opposite or alternate, in terminal spikes, 2(–3) per node. Calyx 5-ribbed, narrow, 3–8 mm (including the teeth), teeth linear, acuminate, shorter than the calyx tube. Corolla light blue, pink or dark purple, 10–15 mm, tube 8–11 mm, bent just below limb, glandular and pubescent with small hairs, sometimes papillae-like; upper lobes 2–3 mm, sharply recurved, lower ± 3 mm. Capsule 1–2 mm.

Flowering and fruiting: August to November, and also sporadically throughout the year.

Distribution and habitat: Southern Oman, Dhofar, common on the escarpment hills, in *Commiphora*, *Delonix*, *Croton confertus* woodland and dense thickets, apparently parasitizing *Cissus quadrangularis* and *Euphorbia* spp., and wild grasses. *Altitude*: 20–300 m. Distributed in tropical and South Africa, tropical Arabia, Indian subcontinent, and Sri Lanka. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 739.

Notes: Mohammed et al. (op. cit.) states that this species is parasitic only on dicotyledons.

2. ***Striga angustifolia*** (D.Don) Saldanha, Bull. Bot. Surv. India 5: 70 (1963).
Basionym: *Buchnera angustifolia* D.Don (1825).

Description: Annual semi-parasitic herb, up to 50 cm. Stems erect, simple, rigid, hispid. Leaves opposite, distantly placed, sessile, 10–35 × 1–3 mm, linear to linear-lanceolate. Lower bracts leaf-like, the upper linear to subulate; bracteoles subulate, ± 4 mm. Flowers axillary, solitary, alternate, forming long lax terminal spikes. Calyx tubular, 5-lobed or with 5 (rarely 4) teeth, 8–10 mm, prominently 10–15-veined; teeth linear-lanceolate, 3–4 mm, elongating in fruit. Corolla white, 2-lipped, pubescent outside, turning bluish-black when dried; tube narrow, ± 10 mm, curved at right angles just above calyx teeth; limb with upper lobes fused, obovate, erect; lower lobes 3, 6–8 mm, obovate, spreading. Stamens 4, didynamous, inserted in the tube below the mouth; anthers monothecous. Capsule 3–4 mm, ovoid, valves recurved after dehiscence.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in *Anogeissus*, *Blepharispermum*, *Croton confertus* woodland, parasitic on shrubby plants. *Altitude*: 10–100 m. Distributed in India and tropical eastern Africa. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 740.

3. ***Striga densiflora*** Benth. in Hook.f., Comp. Bot. Mag. 1: 363 (1836).
Synonym: *Buchnera densiflora* Benth., Scrophul. Ind.: 41 (1835).
Vernacular name: fazmae.

Description: Annual semi-parasitic herb, up to 20 cm. Stems erect, branching from base, sparsely hairy. Leaves opposite, ascending, sessile, 5–7 × ± 1 mm, linear. Lower bracts leaf-like, 6–7 mm, the upper linear to subulate; bracteoles subulate. Flowers axillary, solitary, alternate, in long dense terminal spikes almost the entire length of the stem. Calyx tubular, 5-lobed, teeth 5–5.5 mm, lanceolate, hispid ciliate. Corolla white turning inky blue on drying, 2-lipped, glandular-pubescent outside; tube narrow, 9–10 mm, curved at right angles just above calyx teeth; limb with lobes obovate; lower lobes 3, ± 3 mm. Stamens 4, didynamous, inserted in the tube below the mouth; anthers monothecous. Capsule 4–5 mm, ovoid.

Flowering and fruiting: February, March.

Distribution and habitat: Northern Oman, in cultivations, irrigation ditches, in the foothills of the Hajar mountains, parasitic on sorghum and millet. *Altitude*: 200–400 m. Distributed in India. The Oman record is the only one from the Arabian Peninsula.

Distribution map & Illustration: 741.

4. ***Striga asiatica*** (L.) Kuntze, Rev. Gen. Pl. 2: 466 (1891).
Basionym: *Buchnera asiatica* L. (1753).

Description: Erect annual. Stems square, sparsely branched or if branched then from above the middle, 15–20 cm high, densely hispid. Leaves 8–20 × 1–3 mm, linear to linear-lanceolate, entire, hispid; bracts 9–12 mm long, longer than the calyx; bracteoles ± 2 mm. Flowers opposite or alternate. Calyx tubular, 6 mm (including teeth); teeth ± 2 mm, 10-ribbed. Corolla 2-lipped, scarlet red, outside yellowish, occasionally entirely yellow, tube 10–14 mm, tube bent near limb, sparsely to densely pubescent; limb with the upper lobe emarginate, 4 mm wide; lower lobes spreading, 4 mm long. Style persistent. Capsule 7 mm, narrowly ovoid.

Flowering and fruiting: September?

Distribution and habitat: Southern Oman, Dhofar; collected only once as far as is known, from the Salalah plains by Th. Bent in 1895, locality not known. *Altitude*: ± 30 m. Widespread in tropical Africa, South Africa, Mascarenes, tropical Arabian Peninsula, the Indian subcontinent, China, Indonesia, the Philippines, introduced into USA. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen, semi-parasitic on millet and sorghum.

Distribution map & Illustration: 742.

16. **Buchnera** L.
About 100 species distributed mainly in the tropics and subtropics of the Old World.

Buchnera hispida Buch.-Ham. ex D.Don., Prodr. Fl. Nepal.: 91 (1825).

Description: Annual herb, semi-parasitic, blackening on drying. Stems erect, 10–20 cm, simple or branched, pilose to hispid or scabrid. Leaves alternate or opposite; basal leaves forming a rosette, cauline reducing in size upwards; upper leaves 15–25(–50) × 1–2.5 mm, linear to linear-lanceolate, acute or obtuse, entire or obscurely dentate, 1-veined; lower leaves 45–54(–75) × 9–12(–25) mm wide, lanceolate to ovate-lanceolate to broadly or narrowly oblong, acute or obtuse, cuneate, entire to coarsely irregularly dentate, 3-veined; all leaves hispid-scabrid. Flowers in terminal slender spikes, sessile or with short pedicels; bracts 4–5 × 0.8–1(–3) mm, ovate to lanceolate, acute or acuminate, pilose, hispid or glabrous with ciliate margins; bracteoles 2.8–4 mm, linear-lanceolate to subulate. Calyx 4–8 mm long, 10-veined, sparsely to densely hispid to pilose; lobes 1–2 mm, linear-lanceolate.

Corolla blue, mauve to purple or white; tube 6–7.5 mm, cylindric, straight or rarely curved, glabrous or pilose; lobes 2–2.8 mm, obovate to obovate-oblong, throat villous. Capsule 5 × 3 mm, ovoid.

Flowering and fruiting: September to November.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment hills, in *Anogeissus* woodland and open grassland. *Altitude*: 800–950 m. Widespread in tropical and subtropical Africa, from West Africa to East Africa, Sudan, Ethiopia; Madagascar and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 743.

17. **Leptorhabdos** Schrenk

A single species from the Caucasus and Iran to C Asia and Himalaya.

Leptorhabdos parviflora (Benth.) Benth. in DC., Prodr. 10: 510 (1846).
Basionym: *Gerardia parviflora* Benth. (1835).

Description: Annual herb, up to 50 cm. Stems erect, branched or simple, glabrous and glandular. Leaves opposite, linear pinnatisect with linear segments, up to 30 mm, pubescent and glandular. Flowers in terminal lax spikes; bracts linear, glandular; pedicels short, glandular. Calyx campanulate, ± 4 mm, 5-lobed to 1/2 the length; lobes triangular, glandular. Corolla pink, tubular, ± 4 mm, 5-lobed; lobes ± 1 mm, bifid. Stamens, 4; filaments glabrous, included. Capsule 3–4 mm, oblong to subglobose, dehiscing by 2 valves, brown.

Flowering and fruiting: September.

Distribution and habitat: Northern Oman, on the western Hajar mountains, on the summit, in *Juniperus–Olea* zone with *Eurvops*, *Lonicera aucheri* and *Berberis*. *Altitude*: 2000–2800 m. Distributed from northern Oman through Afghanistan, Pakistan to eastern Transcaucasia, Central Asia and Tien Shan. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 744.

82. **Orobanchaceae**

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In recent molecular studies and the APG III (2009) classification, the Scrophulariaceae s.l. shows Orobanchaceae as a separate monophyletic group that includes the parasitic and semiparasitic species. For the Oman flora this would include beside *Cistanche* and *Orobanche*, *Alectra*, *Buchnera*, *Striga* and *Leptorhabdos*. All species in this family are parasites. Treatment of genera follows Foley (op. cit.)

Key to the genera of Orobanchaceae in Oman
(after Foley 2004)

Corolla ± actinomorphic, subequally 5-lobed ..... 1. **Cistanche**
Corolla zygomorphic, 2-lipped, the upper lip bilobed, the lower 3-lobed .... 2. **Orobanche**

1. **Cistanche** Hoffmanns. & Link
About 20 species distributed in north Africa and western and central Asia; occasional in Europe.

Entire plant yellowish to greyish-violet; corolla 30–50 mm, broadly campanulate .....
..... 1 **C. phelypaea**
Entire plant pinkish; corolla 20–30 mm, narrow infundibuliform ..... 2. **C. rosea**

1. ***Cistanche phelypaea*** (L.) Cout., Fl. Portugal: 571 (1913).
Basionym: *Lathraea phelypaea* L. (1753). *Synonyms*: *Orobanche tinctoria* Forssk. (1775). Type: Yemen, Wadi Mawr (as Mor), Feb. 1763, *Forsskal* 1537 (holotype C); *Cistanche tinctoria* (Forssk.) Beck (1904); *Phelypaea tubulosa* Schrenk (1840); *Cistanche tubulosa* (Schrenk) Hook.f. (1884).

Description: Apparently a perennial 20–50(–80) cm. Stem unbranched, robust, often swollen towards the base, yellow to greyish-violet, fleshy, glabrous. Leaves sessile, 15–30 × 5–12 mm, ovate-lanceolate to lanceolate, obtuse, margins scarious, glabrous, brown. Flowers in dense terminal spikes (10–)15–30(–35) cm, ± cylindrical, showy; bracts 15–20 mm, ovate-lanceolate, crenulated, glabrous; bracteoles 2, 12–15 mm, oblong-lanceolate, adnate to the calyx. Calyx 12–18 mm, campanulate; tube curved, dilated above, 5-lobed, lobes ± equal, suborbicular to broadly oblong. Corolla 30–50 mm, broadly campanulate, tube curved with 2 bosses at throat, bright yellow often flushed violet, pink or purple, glabrous; lobes suborbicular, spreading but usually curved backwards. Stamens 4; filaments hairy below; anthers villous. Capsule loculicidal, 2-valved.

Flowering and fruiting: October to April.

Distribution and habitat: Throughout Oman, including Masirah and Al Halaniyah, parasitic on various hosts especially Chenopodiaceae, Polygonaceae, Tamaricaceae and Zygophyllaceae. Usually coastal on sand and low dunes, but also present inland on saline sandy plains, soft sand, low sand dunes, and on gravel overlain with sand; common and very showy when in flower. *Altitude*: 0–300 m. Widespread from the west coast of Africa and southern Spain, through north Africa, southern Mediterranean and the Middle East to India and Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Kuwait, Saudi Arabia, Yemen, UAE.

Distribution map & Illustration: 745.

Notes: Hepper & Friis (Plants of Pehr Forsskal's Flora Aegyptiaca-Arabica, 1994: 228)

suggest that the name *Lathraea quinquefida* Forssk. for which no type material is found may be a synonym of *Cistanche phelypaea*.

The plant is connected to the host by a long slender root which can extend to several metres.

2. ***Cistanche rosea*** Baker, Bull. Misc. Inform. Kew 1894: 339 (1894), nomen; et in Hook. Ic. Pl.: t. 2363, (1895) descr.
Type: Yemen, Tokham near Mokalla, 24 Dec. 1893, *Lunt*, s.n. (holotype K; isotype BM).

Description: Apparently a perennial 10–20 cm. Stem unbranched, often swollen towards the base, pinkish-red, fleshy, glabrous. Leaves sessile, imbricate, 10–20 × 8–10 mm, ovate to ovate-oblong, obtuse, glabrous, fleshy, pinkish-red. Flowers in dense terminal spikes 8–20 cm, ± cylindrical. Bract smaller than flowers, glabrous; bracteoles 2, lanceolate, adnate to the calyx. Calyx 12–15 mm, campanulate, 5-lobed, lobes ± equal, ovate. Corolla 20–30 mm, narrow infundibuliform, curved or straight, rose-pink to pale pink, glabrous; lobes broadly ovate, pink or white on the inside, erose. Stamens 4; filaments hairy below; anthers villous; stigma orangey-red. Capsule not seen.

Flowering and fruiting: September to November.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment hills, wadis and gorges, rocky slopes, earth banks, often under and in association with *Acacia*, *Commiphora*, *Boswellia*, *Ziziphus spina-christi*; recorded to beparasitic on *Acacia tortilis* and *Pluchea dioscoridis*; not common. *Altitude*: 10–850 m. Elsewhere in the Arabian Peninsula found in Bahrain, Yemen.

Distribution map & Illustration: 746.

Notes: There are only a few sheets of this species at K, with two collections from Oman (*Radcliffe-Smith* 5230 and *Whitehead* 837); I have seen it only once in Dhofar in a gorge by the Salalah–Mughsayl road.

2. **Orobanche** L.

About 150 species distributed from southern Europe through to southwest Asia.

1. Stems simple or branched, glandular-pubescent; bracteoles present 2
   Stems simple, glandular-pubescent; bracteoles absent 3
2. Stems glandular-pubescent; calyx 4-lobed; corolla tubular, white at base, white to blue above ..... 1. **O. ramosa**
   Stem sparsely glandular-pubescent; calyx divided to base into two bifid lateral segments; corolla narrow, mauve to blue ..... 2. **O. perangustata**
3. Margins of corolla lobes with entire margins ..... 3. **O. cernua**
   Margins of corolla lobes prominently erose-denticulate ..... 4. **O. dhofarensis**

1. ***Orobanche ramosa*** L., Sp. Pl.: 633 (1753).

Description: Annual or perennial, up to 25 cm. Stems simple or usually branched from

base, whitish to yellow to pale purple, glandular-pubescent. Leaves 3–10 mm, ovate-lanceolate, glandular-pubescent. Inflorescence spicate, lower flowers ± pedicellate; bracts 5–10 mm, ovate lanceolate, cream to greyish; bracteoles linear-lanceolate, adnate to the calyx. Calyx 5–10 mm, tubular, 4-lobed; lobes lanceolate, acute, glandular-pubescent. Corolla 10–13 mm, tubular, inflated, curved and constricted just above calyx, erect to patent, white at base, white to bluish above with conspicuous white bosses inside throat, glandular-pilose; upper lip slightly bilobed; lower lip 3-lobed, margins ± entire. Stamens 4, glabrous; anthers glabrous. Stigma lobes cream-white or bluish. Capsule ± 5 mm, ovoid.

Flowering and fruiting: March to April.

Distribution and habitat: Northern Oman, on the Hajar mountains, on open stony ground, rocky hill slopes, and in cultivated farms, host not known but possibly parasitic on *Rumex*. *Altitude*: 1500–2000 m. Distributed throughout southern Europe, also Turkey, Lebanon, Israel, Cyprus. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen.

Distribution map & Illustration: 747.

2. ***Orobanche perangustata*** M.Y.J.Foley, Candollea 59(2): 240, plate 1 (2004).
Type: Oman, an Nid, 2500 m, in cultivations of lucerne, 21.3.1976, *Radcliffe-Smith* 3979 (holotype K; isotype ON).

Description: Annual or possibly perennial, 15–25 cm. Stems simple or sparsely branched, stems and branches narrow, pale yellow-brown, sparsely glandular-pubescent. Leaves rather few, 3–7 mm, lanceolate, glandular-pubescent. Inflorescence spicate, remote-flowered, lax, lower flowers ± pedicellate; bracts 6–10 mm, ovate-lanceolate; bracteoles 4–5 mm, linear, adnate to the calyx. Calyx 5–7 mm, campanulate, 4-lobed divided to base into bilobed segments ± equalling the tube, sparsely pilose to glabrous. Corolla 12–16 mm, very narrow, erect to patent, inflated proximally, constricted immediately above, then ± tubular, widening slightly towards the limb, mauve to blue; upper lip slightly bilobed; lower lip lobes rounded, margins ± entire. Stamens 4, glabrous with few hairs at base; anthers white, glabrous.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, on the Hajar mountains, and Musandam, on rocky hill slopes, and in cultivated areas. *Altitude*: 600–1900 m. So far known only from northern Oman; endemic.

Distribution map & Illustration: 748.

Notes: Foley records four collections from northern Oman. I have not seen or collected this species despite many collecting trips to the areas where this species occurs. This species was last collected in 1983 from Musandam. Rapid development and road building in the last two decades have led to a noticeable decrease in species richness in many areas of northern Oman. In view of its limited occupancy and continued degradation of habitat, this species is assessed as Endangered [EN A2 (c, d)] on the IUCN and National Red Lists.

3. ***Orobanche cernua*** L., Sp. Pl.: 633 (1753).

Description: Annual or perennial, up to 30 cm. Stems simple, yellow to pale violet, ± glandular-pubescent. Leaves 5–10 × ± 5 mm, ovate-lanceolate, yellowish, sparsely glandular-pubescent. Inflorescence spicate, dense; bracts 8–10 mm, ovate, yellow, glandular-pubescent. Calyx 7–12 mm, calyx divided into two bifid lateral segments, teeth acuminate, pale yellow-blue, glandular-pubescent. Corolla 12–15 mm, erect to patent, tubular, inflated proximally, curved, the tube cream, tinged blue-mauve to purple, sparsely glandular-pubescent; upper lip slightly bilobed; lower lip 3-lobed, lobes rounded, margins ± entire. Stamens 4, glabrous above, ± hairy below; anthers glabrous or hairy. Stigma lobes cream-white. Style glandular-pilose

Flowering and fruiting: February to April.

Distribution and habitat: Northern and Southern Oman, in the foothills of the mountains, on open stony ground, gravel and silty soils, rocky hill slopes, and in cultivations; recorded to be parasitic on cultivated legumes and tomato. *Altitude*: 150–800 m. Distributed throughout southern Europe, Africa, Asia and Australia; introduced in several areas. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, Yemen, UAE.

Distribution map & Illustration: 749.

4. ***Orobanche dhofarensis*** M.J.Y.Foley, Edinb. J. Bot. 55: 230 (1998).
Type: Oman, Dhofar, west of Ashinhaib, 22.9.1993, *Collenette* 8887 (holotype ON, central specimen & photo; isotype E).

Description: Annual or perennial, (10–)15–25(–35) cm. Stems simple, slender, ± glandular-pubescent. Inflorescence very lax, and with spaced flowers; bracts lanceolate. Calyx segments divided into two bifid lateral segments with acuminate teeth, ± glandular-pubescent. Corolla ± campanulate, ± 12 mm, curved, the tube white to cream, margins of lobes prominently erose-denticulate. Stamens 4, glabrous above, ± hairy below. Stigma lobes pink or white.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in *Anogeissus* woodland; host not known but possibly parasitic on *Plectranthus* spp. and *Impatiens balsamifera*. *Altitude*: 200–1000 m. Endemic to Dhofar in southern Oman.

Distribution map & Illustration: 750.

83. Acanthaceae

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A large family with 2500 -3000 species distributed in all tropical and subtropical regions and extending into warm temperate regions. The family is divided into 4 subfamilies, Nelsonioideae, Thunbergioideae, Acanthoideae and Ruellioideae, of which representatives of the latter two are represented in Oman. Genera belonging to these two subfamilies, and tribes of Ruellioideae can be distinguished by the following characters (adapted from Vollesen (2008) cited above):

Plants without cystoliths; calyx 4–5-lobed; stamens 4, anthers 1-thecous; seeds 2 -4 .... Subfamily Acanthoideae (*Blepharis*)

Plants with cystoliths; calyx (4)5-lobed; stamens 2–4, anthers 1–2-thecous; seeds 2– many ..... Subfamily Ruelloideae

Subfamily Ruelloideae

1. Stigma with 2 equal oblong-ellipsoid lobes; seeds without hygroscopic hairs .... Tribe Justicieae (*Asystasia, Ecbolium, Hypoestes, Isoglossa, Justicia, Megalochlamys, Ruttya*)

   Stigma with 2 unequal lobes (2 equal subcapitate to obconical lobes in *Barleria*); seeds with hygroscopic hairs 2

2. Stamens 4, anthers 2-thecous (*Barleria*) or one pair 1-thecous and the other 2-thecous (*Neuracanthus, Lepidagathis*); stigma with linear or rounded lower lobe, the upper lobe missing or reduced to a small tooth, or with 2 equal subcapitate to obconical lobes (*Barleria*) ..... Tribe Barlerieae (*Barleria, Neuracanthus, Lepidagathis*)

   Stamens 4, anthers 2-thecous; stigma with linear lobes, the lower usually smaller and reduced to a tooth ..... Tribe Ruellieae (*Dyschoriste, Peristrophe, Ruellia*)

Key to the genera of Acanthaceae in Oman

1. Stamens 4 2

   Stamens 2; sometimes staminodes present 7

2. Plants with spiny bracts; calyx 4-lobed; corolla 1-lipped ..... 1. **Blepharis**

   Plants without spiny bracts; calyx 4-lobed; corolla 2-lipped or ± equally 5-lobed ... 3

3. Corolla 2-lipped ..... 6. **Lepidagathis**

   Corolla ± equally 5-lobed 4

4. Filaments fused in pairs; anthers with short tails ..... 2. **Dyschoriste**

   Filaments not as above; anthers without tails 5

5. Bracts with acuminate apex ending in a spine ..... 7. **Neuracanthus**
Bracts not as above 6
6. Bracteoles exceeding the calyx; corolla usually with a cylindrical tube; palate not wrinkled ..... 3. **Ruellia**
Bracteoles minute; corolla not tubular, palate wrinkled ..... 4. **Asystasia**
7. Plants often with axillary spines; calyx 4-lobed; corolla 5-lobed with all lobes ± equal or one smaller than the other 4 ..... 5. **Barleria**
Plants without axillary spines; calyx 5-lobed (if 4-lobed then Barleria hochstetteri); corolla 2-lipped 8
8. Anthers 1-celled 9
Anthers 2-celled 10
9. Undershrub; flowers < 2 cm, white or blue with purple markings in throat ..... 9. **Hypoestes**
Shrub or small tree; flowers > 2 cm, orange-red with black throat ..... 10. **Ruttya**
10. Inflorescence paniculate; bracts very unequal ..... 8. **Dicliptera**
Inflorescence spicate; bracts ± equal 11
11. Anther-cells displaced with one cell above the other, the lower with a basal appendage ..... 13. **Justicia**
Anthers-cells parallel, without basal appendages 12
12. Corolla tube longer than the lobes; upper lobe emarginate ..... 11. **Ecbolium**
Corolla tube shorter than the lobes; upper lobe entire ..... 12. **Megalochamys**

1. **Blepharis** Juss.

About 126 species distributed in Africa, Madagascar, Arabian Peninsula, Middle East to India, Indo-China, Malesia to Java.

1. Leaves linear-oblong, apparently in whorls of 4; inflorescence apparently arising in the forks of branches; bracts with a recurved spiny tip ..... 2. **B. scindica**
Leaves oblong to ovate, two opposite each other; inflorescence and bracts not as above 2
2. Low woody perennial; leaves 10–60 mm long; inflorescence of short spikes; peduncle 5–30 mm ..... 1. **B. ciliaris**
Shrub or small tree; leaves 5–18 cm long; inflorescence of flowers congested into a head subtended by 4 leafy bracts; peduncle 6–15 cm ..... 3. **B. dhofarensis**

1. ***Blepharis ciliaris*** (L.) B.L.Burtt, Notes R.B.G. Edinb. 22: 94 (1956).
Basionym: *Ruellia ciliaris* L. (1767).
Vernacular names: nigely, nigeyl.

Description: Low woody perennial (in Oman) shrub, up to 30 cm, branching from the base. Stems erect to decumbent. Leaves deciduous, opposite, 10–60 × 3–15 mm, oblong to narrow ovate to elliptic-ovate, margins with up to 10 teeth per side, apex spine-tipped, puberu-

lous; bracts 2–5 pairs, sterile, 3-5 cm, pubescent, margins with 3-5 pairs of spines; apex with a long spine. Flowers 2–30 in short spikes; peduncle 5–30 mm. Calyx of 4 unequal lobes; dorsal 13–18 mm, 5–7-veined from base, broadly elliptic-ovate, apex (1–)3-toothed; ventral 8–12 mm, 2-toothed; lateral 6–8 mm, ovate. Corolla white with purple veins to purple-blue, 15–20 cm long, 1-lipped, flat with 3 obtuse lobes, the central largest, puberulous beneath; corolla united basally to form a short tube 4–6 mm. Stamens 4, attached at the mouth of the corolla tube, exserted. Capsule 7–8 mm long, ovoid, flattened, glabrous. Seeds hairy, becoming mucilaginous on wetting.

Flowering and fruiting: December to March.

Distribution and habitat: Northern and central Oman, common in stony and arid gravely areas; often in sandy patches or amongst stones in wadis; common. *Altitude*: 10–800 m. Distributed in Iran and Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

Distribution map & Illustration: 751.

Notes: The seeds are released explosively when the plant is moistened. The plant is drought resistant and sheds its leaves in the summer months.

2. ***Blepharis scindica*** T.Anderson, J. Linn. Soc. 7: 36 (1863).
Synonyms: *Blepharis edulis* sensu T.Anderson (1867) non (Forssk.) Pers. (1806); *B. linariifolia* sensu C.B.Clarke (1899), p.p.; Miller & Morris, Pl. Dhofar: 8 (1988).
Vernacular names: esbed, asker, ada an, sebbin (Jibbali).

Description: Perennial herb up to 40 cm, branching from the base. Stems erect to decumbent to trailing, puberulous. Leaves opposite or apparently in whorls of 4, grey-green above, whitish beneath, 16–60 × 2–5 mm, linear-oblong, sessile, apex with a small mucro at the tip, margins entire, scabridulous above, glabrous beneath; bracts overlapping, with a recurved spiny tip; bracteoles softly spiny, sericeous. Flowers in congested erect spikes 4–20-flowered, in the forks of branches; peduncle 5–50 mm. Calyx of 4 unequal lobes, sericeous; dorsal 12–18 mm, 5–7-veined from base, broadly elliptic-ovate, apex (1–)3-toothed; ventral 8–12 mm, 2-toothed; lateral 6–8 mm, ovate. Corolla white with purple veins, 15–20 cm long, 1-lipped, flat with 3 obtuse lobes, glabrous beneath; corolla united basally to form a short tube ± 4 mm. Stamens 4, attached at the mouth of the corolla tube. Capsule 6–7 mm long, ovoid, flattened, glabrous. Seeds hairy, becoming mucilaginous on wetting.

Flowering and fruiting: December to March.

Distribution and habitat: Southern Oman, Dhofar in the dry coastal plains and north-draining wadis, also Al Halaniyat Island in shallow stony coastal wadi bank. *Altitude*: 10–800 m. Distributed in Pakistan, India. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 752.

3. ***Blepharis dhofarensis*** A.G.Mill., Notes R.B.G. Edinb. 45(1): 63–66 (1988).
Type: Oman, Dhofar, Wadi Gerzid, 600 m (2000 ft.), 1895, *J.T. Bent*110 (holotype K).
Vernacular names: ayzob (Jibbali); alib, aylob (Dhofar Arabic).

Description: Shrub or small tree, up to 5 m, branching throughout; wood with prominent lenticels. Leaves opposite, 5–18 × 1–4.5 cm, narrowly elliptic, margins with a few weak spinules, apex spinulose, base sessile or attenuating into a short petiole bearing pair of spinules at the base; bracts and bracteoles in the inflorescence obovate to rhomboid, spiny towards the apex, tip spiny, sericeous; lower bracts sterile; bracteoles 2 per bract. Flowers 8–10, congested into a head subtended by 4 leafy bracts; peduncle 6–15 cm. Calyx of 4 unequal lobes sericeous; dorsal ± 32 × 10 mm, apex with 2 weak spines; ventral similar to dorsal lobe, ending in one weak spine; lateral ±16 × 6 mm, ovate. Corolla white, 1-lipped, 40–45 mm, unequally 5-lobed, the central lobe largest; tube ± 8 mm; glabrous outside with a ring of hairs at mouth inside. Stamens 4, attached at the mouth of the corolla tube. Capsule 12 × 8 mm, oblong-ovoid, flattened, brownish-red, glabrous. Seeds flattened, ovate, white to whitish-brown, adpressed hairy, hairs swelling and becoming mucilaginous on wetting.

Flowering and fruiting: August, September (at the end of the monsoon season).

Distribution and habitat: Southern Oman, Dhofar, on the wet escarpment mountains with *Anogeissus*, *Euclea* and extending into the drier *Acacia-Commiphora* shrubland. *Altitude*: 600–900 m. A regional endemic, elsewhere in the Arabian Peninsula found in Yemen (SE).

Distribution map & Illustration: 753.

Notes: Restricted to the escarpment woodlands from Dhofar to southern Yemen (Hauf and Ras Fartak in Mahra). On the National Red List it is assessed as Vulnerable [VU B1+2c] because of its limited geographical range and continued habitat degradation from over-grazing.

2. **Dyschoriste** Nees
About 65 species distributed in SW Arabia, tropical Africa to South Africa, Madagascar, India east to Borneo; also S USA to Argentina.

Dyschoriste dalyi A.G.Mill., Notes R.B.G. Edinb. 45(1): 66–68 (1988).
Type: Oman, Dhofar, Jebel Qara, c. 15 km SE of Jibjat, dry rocky wadi with *Anogeissus dhofarica*, *Commiphora* spp., 900 m, 30. ix 1979, *Miller* 2377 (holotype E; isotype K, ON)
Vernacular names: zifed, dayfed (Jibbali).

Description: Perennial. Stems prostrate to decumbent, reddish-green, up to 60 cm, often rooting at the nodes. Leaves 10–40 × 3–20 mm, obovate, base attenuating into a short petiole, apex acute, margins entire, somewhat undulate, white tomentose when young becoming glabrous with age. Flowers 1(–2) in the axils of leaves; pedicel 1–2 mm; bracts foliaceous. Calyx 13–16 mm, lobed to 3/4 its length into linear lobes (in fruit becoming lobed almost to base). Corolla 2-lipped, purple to pale pink-purple with dark purple markings on lower lobes and throat, 16–20 mm, united basally to form a tube ± 15 mm; upper

lip 2-lobed, lobes retuse; lower lip 3-lobed, lobes oblong, retuse to rounded, spreading. Stamens 4; filaments fused in pairs; anthers with a short tail. Capsule 8–10 mm, narrow-oblong, brown, glabrous, 4-seeded. Seeds oblong, densely covered with hairs.

Flowering and fruiting: August to November.

Distribution and habitat: Southern Oman, Dhofar, in the escarpment woodlands, on open rocky ground, on summit in *Themeda quadrivalvis* grassy areas; common in the *Euphorbia balsamifera* zone and along roadsides. *Altitude*: 300 -1250 m. Distributed in SE Yemen. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 754.

Notes: A regional endemic found in Dhofar and SE Yemen. This species is closest to two other species, *D. radicans* from tropical East Africa and the western Arabian escarpment mountains and *D. longicalyx*, an endemic species from S Yemen. However it is distinguished from both in its larger corolla and habit. The species is named after Ralph Daly, adviser on conservation to the Diwan of Royal Court, Oman.

3. **Ruellia** L.

About 150 species distributed in the tropical regions of the world.

1. Plants with stellate and simple hairs; corolla tube more than 50 mm long ..... 4. **R. discifolia**
   Plants with simple hairs only; corolla tube less than 50 mm long 2
2. Calyx 4–5 mm, lobes ovate-lanceolate; capsule glabrous ..... 2. **R. patula**
   Calyx longer than 5 mm; lobes linear to linear-lanceolate; capsule pubescent 3
3. Leaves linear-lanceolate; bracteoles linear; calyx lobes 6–8 mm, linear ... 1. **R. sindica**
   Leaves ovate to ovate-oblong; bracteoles as leaves; calyx lobes 10–15 mm, linear-lanceolate ..... 3. **R. prostrata**

1. ***Ruellia sindica*** Ghafoor & Heine, Willdenowia 16: 122 (1986).

Synonyms: *Dipteracanthus longifolius* Stocks (1852); *Ruellia longifolia* (Stocks) T.Anderson (1867) nom. illeg., non *R. longifolia* Rich. (1792), nec *R. longifolia* (L.) Roxburg (1832) nom.

Description: Small shrub, up to 30 cm. Stems branching at the base, angled, glandular-pubescent. Leaves 15–30 × 3–4 mm, linear-lanceolate, pubescent, apex acute, base tapering into the petiole, margins entire. Flowers solitary in the axils of leaves, short-lived, fragrant; bracts absent; bracteoles 16–18 mm, linear-oblanceolate, pubescent. Calyx lobes linear, 6–8 mm, strigose. Corolla pale purple, pubescent without, tubular; tube ± 12 mm, expanded and 5-lobed above, lobes 8–10 mm, rounded, spreading. Stamens 4, included; anthers parallel. Style persisting in mature capsule. Capsule 15–17 mm, clavate, hairy, 8-seeded.

Flowering and fruiting: April.

Distribution and habitat: Northern Oman, in the foothills of the eastern Hajar mountains. *Altitude*: ± 250 m. Elsewhere known only from southern Pakistan.

Distribution map & Illustration: 755.

Notes: One of the several species showing a disjunct distribution; not known in the western Hajar mountains or on the Musandam mountains. Known from a single collection in the eastern Hajar, but perhaps under-collected. Distinguished from the other species in its linear-lanceolate leaves. See Ghafoor & Heine (op. cit.) for full synonymy of this species.

2. ***Ruellia patula*** Jacq., Misc. 2: 358 (1781).

Description: Woody small shrub with annual stems or a perennial, up to 50 cm. Stems branching at the base, pubescent. Leaves dull green, pubescent (sometimes lanate), 10–30(–50) × 8–20(–30) mm, lanceolate to broadly ovate to oblong-ovate, apex rounded with an acute tip, base rounded to shortly cuneate, margins entire to irregularly crenulate; petiole 10–15 mm. Flowers 1–3 in axillary cymes, short-lived, usually in the upper axils of leaves; bracts foliaceous. Calyx 4–5 mm, 5-lobed with ovate-lanceolate lobes and often a narrow hyaline margins. Corolla pale lilac to pink or bluish, funnel-shaped, tube 8–12 mm, 5-lobed above, pubescent; lobes ± 6 mm. Stamens 4; anthers parallel. Style persisting in mature capsule. Capsule 12–18 mm, ellipsoid, many-seeded, glabrous.

Flowering and fruiting: March to April.

Distribution and habitat: Northern and Southern Oman, in the foothills of the Hajar mountains, in stony and disturbed sites, and edges of cultivations; in Dhofar in rocky wadi beds with *Commiphora*, *Croton*, *Boscia* and *Boswellia*; common. *Altitude*: 250–800 m. Widespread in tropical Africa, India, Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 756.

3. ***Ruellia prostrata*** Poir., Encycl. Meth. 6(1): 349 (1804).

Description: Small shrub up to 1 m. Stems erect to ascending, ascending, branching from base, pubescent. Leaves ovate to ovate-oblong, 25–70 × 15–40 mm, pubescent, apex obtuse, base rounded to shortly cuneate, margins entire or undulate; petiole up to 2 cm. Flowers 1–3, in the axils of leaves, short-lived. Calyx 10–15 mm, 5-lobed with linear-lanceolate lobes. Corolla violet to pale purple, funnel-shaped, expanded and 5-lobed above; tube ± 15 mm; lobes ± 5 mm. Stamens 4; anthers parallel. Style persisting in mature capsule. Capsule ellipsoid, ± 15–20 mm, greenish when mature, many-seeded, finely pubescent with adpressed hairs.

Flowering and fruiting: September, October.

Distribution and habitat: Southern Oman, recorded from the foothills and plains in Dhofar; not common. *Altitude*: 50–100 m. Distributed from Angola and eastern Africa to South Africa, and through Sudan, Ethiopia and Somalia to Yemen and Oman; also in India, Sri

Lanka and South Pacific Islands. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 757.

4. ***Ruellia discifolia*** Oliv., Icon. Pl. ser. 3, 6: tab. 1511 (1886).

Description: Small shrub up to 1 m. Stems and young branches white-lanate with stellate hairs. Leaves dark green or grey-green above, grey-green beneath, stellate and ± simple hairy, 18–80(–100) × 10–60(–85) mm, ovate to ovate-orbicular, apex acute, base rounded to attenuate to cordate, margins entire or irregularly crenulate; petiole up to 60 mm. Flowers solitary or 2, in the upper axils of leaves, short-lived, nocturnal, opening at dusk and falling by midday the next day. Bracteoles foliaceous, enlarging in fruit. Calyx 12–25 mm, deeply 5-lobed with lanceolate lobes, stellate hairy. Corolla white or cream, tubular, tube 55–70 mm, expanded and lobed above into 5 lobes, 25–40 mm across; lobes ± 10 mm, rounded. Stamens 4; anthers parallel. Capsule ± 20 mm, many-seeded, pubescent with simple and stellate hairs.

Flowering and fruiting: March; September.

Distribution and habitat: Northern and southern Oman; in the north in the foothills of the eastern Hajar mountains, and in Dhofar in the lower slopes of the escarpment woodlands, and rocky limestone places in the *Acacia, Commiphora, Boswellia* and occasional *Dracaena* shrubland. *Altitude*: 20–500 m. Distributed in Kenya, Ethiopia, Somalia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 758.

Notes: A robust form of this species is found in Dhofar, with leaves 70–80 × 55–70 mm and petiole 70 mm long; calyx 22 mm; flower tube ± 70 mm long with the upper lobed part 35 mm across (*Miller & Nyberg* 9259, *Radcliffe-Smith* 5240 & 5109). *Miller* 2642 is somewhat intermediate between the typical smaller leaved and this form. *R. grandiflora* (Forssk.) Blatter (=*R. longiflora* Vahl) is a distinct species found in Yemen and Saudi Arabia which has leaves ± similar to *R. discifolia*, but are not as grey-green, and has much longer corolla tube to 10 cm. This species has been recorded from Dhofar (Patzelt, unpublished) but I have not seen any material from Oman. The record needs confirmation.

Species doubtfully recorded

Ruellia carnea Balf.f. (1883).

Description: Woody undershrub, up to 1 m. Young stems and leaves lanate with stellate hairs and ± glandular and simple hairs. Leaves opposite, dark green, 18–40 × 10–20 mm, ovate to ovate-orbicular, apex acute, base rounded, margins entire or irregularly crenulate; petiole up to 15 mm. Flowers short-lived, solitary in the axils of leaves; bracts foliaceous; bracteoles longer than the calyx. Calyx 12–15 mm, 5-lobed, lobes ovate-lanceolate. Corolla bright red, tubular; tube ± 25 mm, expanded and lobed above into 5 equal lobes; lobes 12–15 mm. Stamens 4; anther cells parallel. Capsule ± 20 mm, many-seeded, pubescent.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, in the escarpment woodlands, with *Anogeissus*, *Delonix*, *Acacia*, *Commiphora*; not common. *Altitude*: 500–800 m. Distributed in north eastern Africa (Ethiopia, Somalia). Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Notes: I have not seen this species in Dhofar but have seen it in the adjacent Mahra region of Yemen. It is reported from Dhofar and very likely to be present there, although its conspicuous red flowers should have made this species quite collectable.

4. **Asystasia** Blume

About 50 species distributed from tropical Africa to South Africa and W Ocean Islands, Arabian Peninsula through India to S China through Asia to N Queensland.

Asystasia gangetica (L.) T.Anderson, Pl. Zey. 235 (1864).
Basionym: *Justicia gangetica* L. (1759). *Synonym*: *Asystasia coromandeliana* Nees (1832).

subsp. ***micrantha*** (Nees) Ensermu, Proceed. XIII Plenary Meeting of AETFAT: 343 (1994).
Synonym: *A. coromandeliana* Nees var. *micrantha* Nees (1847).
Vernacular name: soudoud.

Description: Perennial herb, with a woody base giving annual stems, much branched, up to 50 cm. Stems erect to ascending or creeping, rooting at the nodes, sparse to dense pubescent with long spreading hairs. Leaves opposite, 15–65 × 10–30 mm (up to 90 mm long in specimens from Yemen), broadly ovate to ovate, apex obtuse, base attenuating into the petiole up to 20 mm long, margins entire, sometimes somewhat undulate, pubescent on both surfaces; bracts minute. Flowers solitary at each node of terminal or axillary racemes; pedicels slender, up to 20 mm. Calyx 5–6 mm, segments unequal, linear. Corolla white with mauve to purple stripes in throat, palate wrinkled, 16–25 mm, with 5 equal lobes. Capsule 18–20 mm, with long hairs, dehiscing by 2 valves.

Flowering & Fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the base of the escarpment mountains, in wadis, amongst rocks in *Anogeissus-Delonix* woodland. *Altitude*: 30–200 m. Distributed in Ethiopia, Eritrea, Djibouti, Sudan west to Senegal, south to South Africa, and Madagascar. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 759.

Notes: I have not collected this species; it is known from a couple of specimens and it is not common. On the National Red List this species is assessed as Vulnerable [VU A4 (a, c, d)] due to rapid degradation and over-grazing of the habitat where it is found. Subsp. *gangetica* with corolla more than 25 mm long occurs from tropical Asia to the Pacific Islands and is introduced elsewhere.

5. **Barleria** L. (nom. cons.)
Somalia Oliv.
About 300 species distributed from tropical Africa to South Africa and W Indian Ocean Islands, Arabian Peninsula to India, S China to Philippines; also Mexico to Ecuador.

1. Plants unarmed 2
   Plants spiny 3
2. Leaves green above, silvery green below, pubescent with sparse glandular hairs, more so on the margins and nerves, especially on younger leaves ..... 2. **B. argentea**
   Leaves grey-green, ± glabrous to white pubescent with glandular and eglandular hairs ..... 1. **B. hochstetteri**
3. Axillary spines 4 in each leaf-axil; flowers yellow to orange 4
   Axillary spines 2 in each leaf-axil; flowers white or bluish 5
4. Leaves obovate to oblanceolate, 4-6 mm wide; axillary spines up to 10 mm ..... 5. **B. proxima**
   Leaves suborbicular or broadly oblong to broadly ovate, 8-15 mm wide; axillary spines up to 35 mm ..... 6. **B. samhanensis**
5. Axillary spines with distinct the lateral spines 7–8 mm long; outer calyx lobes broadly ovate, ± 20 × 15 mm; corolla tube 75–80 mm ..... 3. **B. acanthoides**
   Axillary spines with the lateral spines smaller than 7 mm or absent 6
6. Outer calyx lobes lanceolate, 10–15 × 5–6 mm; inner lobes 9–10 mm; corolla tube ± 20 mm ..... 4. **B. candida**
   Outer calyx lobes broadly ovate, ± 10 × 8 mm; inner lobes 6–7 mm; corolla tube ± 20 mm ..... 7. **B. almughsaylensis**

1. ***Barleria hochstetteri*** Nees in DC., Prodr. 11: 231 (1847).
Synonym: *Barleria aucheriana* Nees (1847). Type: Oman, Muscat, *Aucher-Eloy* 5222 (syntypes G, K, P).

Description: Small shrub, up to 40 cm, often stunted and much-grazed. Stems unarmed, grey-green, with opposite lateral shoots, sometimes ending with sharp tips, densely pubescent with spreading medifixed or ± glandular hairs. Leaves opposite, 8–20 × 3–5 mm, lanceolate to narrow lanceolate to oblanceolate, apex obtuse to rounded or apiculate, base tapering into a short petiole 1–2 mm, margins entire, ± glabrous to white pubescent with adpressed medifixed hairs and glandular and eglandular hairs. Flowers white to pale violet, with dark purple spots in throat, solitary to 2, terminal on lateral branches. Bracteoles foliaceous. Calyx 5-lobed, with outer lobes lanceolate to narrowly ovate, bifid, ± 5 mm, glandular and pubescent. Corolla tubular, tube ± 7 mm, 5-lobed, lobes 8–10 mm, the anterior lobe largest. Stamens 2 fertile. Capsule 10–11 mm, with a conical apical beak, densely pubescent, 2-seeded; seeds woolly.

Flowering and fruiting: December to April in northern Oman; September to October in Dhofar.

Distribution and habitat: Northern and Southern Oman, in the Hajar mountains, on exposed hillsides, gorges and wadis, amongst stones and in rock crevices, often with *Euphorbia larica* etc; in Dhofar, on the foothills of the escarpment hills, on open rocky ground and in wadis, in the *Anogeissus-Commiphora* scrub. *Altitude*: 100–1800 m. Distributed in north and tropical east Africa (Ethiopia, Eritrea, Sudan, Kenya), Pakistan, India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 760.

Notes: This is a widespread species which grows in various habitats and shows a fair amount of variation in vegetative characters. Plants from drier habitats are stunted and generally have smaller leaves and densely pubescent whitish stems. *B. aucheriana* Nees in DC., Prodr. 11: 234 (1847) described from Oman is a smaller stunted form of *B. hochstetteri* (see also Maconochie 3528 from Dhofar, Mirbat). Robust forms of *B. hochstetteri* also exist (see Radcliffe-Smith 5239 from Dhofar, Jebel Qamar, lower Wadi Sayq with leaves up to 60 × 27 mm and flowers up to 20 mm).

2. ***Barleria argentea*** Balf.f., Proc. Roy. Soc. Edinb. 12(113): 86 (1883).
Synonyms: *Somalia diffusa* Oliv. (1886); *Barleria diffusa* (Oliv.) Lindau (1894).

Description: Small shrub, up to 30 cm. Stems unarmed, branching from base, grey-green, adpressed pubescent with spreading medifixed and ± glandular hairs. Leaves opposite, green above, silvery-green below, 15–40 × 9–20 mm, oblong-lanceolate to ovate, base rounded to slightly cuneate, apex obtuse, margins entire, pubescent with sparse glandular hairs more so on the margins and nerves, especially on younger leaves; petiole 1–2 mm. Flowers 1–3, axillary; pedicel 2–3 mm. Bracteoles foliaceous. Calyx 4-lobed, lobes lanceolate to triangular, outer lobes ± 7 mm, inner smaller to 5 mm, glandular and pubescent. Corolla blue to violet, falling soon, tubular, 5-lobed, tube 10–14 mm, lobes 3–4 mm, the anterior lobe largest. Stamens 2 fertile. Capsule 13–14 mm, with an apical beak ± 2 mm, pubescent, 2-seeded; seeds woolly.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, on open rocky ground and in wadis, in the *Anogeissus-Commiphora* scrub. *Altitude*: 200–1700 m. Distributed in Ethiopia, Somalia, Kenya, and Tanzania. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 761.

Notes: The species *B. hochstetteri*, *B. argentea* and *B. parviflora* (type from Ethiopia) form a complex and widespread group with variations and overlap of vegetative characters amongst the species that requires further study. In Oman *B. argentea* is distinguishable by its green leaves and silvery stems.

3. ***Barleria acanthoides*** Vahl, Symb. Bot. 1: 47 (1790).
Type: Yemen, *Forsskål* 3779 (lectotype C; photo K).

Description: Small shrub, up to 30 cm, sparsely to much branched. Stems spiny, densely pubescent with spreading hairs. Leaves opposite, 8–30 × 8–10 mm, narrow ovate to obovate, apex mucronate with a long spine, base tapering into a short petiole 2–3 mm, margins entire, densely whitish pubescent with ± spreading hairs; leaves on axillary shoots transformed to spines (axillary spines) with up to 10 mm apical spine and 7–8 mm lateral spines. Flowers white, nocturnal, in axillary congested scorpioid racemes; bracteoles spiny. Calyx scarious, 4-lobed, outer lobes broadly ovate, up to 20 × 15 mm, with apical spine, veins distinct; inner lobes 10–12 mm, without apical spine. Corolla 5-lobed, tube cylindrical, 75–80 mm, lobes ± 20 mm across. Stamens 2 fertile. Capsule up to 11 mm, shortly beaked, glabrous, 4-seeded.

Flowering and fruiting: Flowering September, October.

Distribution and habitat: Southern Oman, Dhofar, on dry limestone coastal hills, dry wadi beds, and rocky and stony areas in *Acacia-Commiphora* and with *Acacia* and *Ziziphus leucodermis* shrubland. *Altitude*: 100–500 m. Distributed in north and tropical east Africa (Ethiopia, Eritrea, Djibouti, Egypt, Sudan, Uganda, Kenya, Tanzania), Pakistan, India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 762.

Notes: Not common but may be under-collected.

4. ***Barleria candida*** Nees in DC., Prodr. 11: 240 (1847).
Type: Oman, Muscat, [Mascate], *Aucher-Eloy* 5223 (syntypes G, K, P, W).

Description: Small shrub, up to 40 cm, simply or much branched. Stems greyish or whitish, densely adpressed pubescent. Leaves opposite, (3–)5–10 × 3–6 mm, obovate to broadly ovate, apex mucronate or with an apical spine (sometimes apex without spine or emarginate), base tapering into a short petiole 1–2 mm, margins entire, white pubescent; axillary spines 10–30 mm, white, lateral spines ± absent (up to 5 mm in some Yemen material). Flowers white (probably nocturnal), solitary, axillary on lateral branches. Calyx scarious when mature, tinged pink when young, 4-lobed, outer lobes 10–15 × 5–6 mm, lanceolate, mucronate, pubescent, midrib prominent; inner lobes 9–10 mm. Corolla tubular, 6–7 mm, 5-lobed; lobes unequal, the anterior lobe largest. Stamens 2. Capsule 10–11 mm, ovoid, shortly beaked above, glabrous, 4-seeded.

Flowering and fruiting: March to May.

Distribution and habitat: Northern Oman, the foothills and lower slopes of the Hajar mountains; amongst rocks, often with *Euphorbia larica*. *Altitude*: 500–850 m. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 763.

5. ***Barleria proxima*** Lindau, Ann. Ist. Bot. Roma 6: 72 (1896).

Description: Small shrub sometimes cushion-forming, up to 50 cm, branched, spiny. Stem

grey-white, ± glabrous to sparsely pubescent with spreading hairs. Leaves opposite, 8–15 × 4–6 mm, obovate to oblanceolate, apex mucronate with a spine, base tapering into a short petiole 1–3 mm, margins entire, glabrous to white pubescent. Axillary spines 4 in each leaf axil, up to 10 mm, on a short common stalk (spines forming from lower axillary bud). Flowers bright orange, 1–2, terminal on lateral branches; bracts lanceolate to oblanceolate; bracteoles spiny. Calyx grey-green, 4-lobed, 10–15 mm, outer lobes similar, mucronate, glabrous or pubescent. Corolla bright orange, tubular, 2-lipped, with 4 lobes in the upper lip, one lower lobe; lobes 6–7 mm. Stamens 2 fertile. Capsule ± 9 mm, ovoid, beaked, glabrous to pubescent, 2-seeded. Seeds with hygroscopic hairs.

Flowering and fruiting: September, October.

Distribution and habitat: Southern Oman, Dhofar, on the coastal escarpment, amongst rocks, in crevices of rocks. *Altitude*: 100–800 m. Distributed in Ethiopia, Djibouti, N Kenya. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 764.

6. ***Barleria samhanensis*** Knees, Miller & Patzelt, Edinb. J. Bot. 64(1): 107–112 (2007). Type: Oman, Dhofar, Jebal Semhan, on cliffs and rocky outcrops on the headwaters of NW draining wadis, 1404 m, 25 ix 2006, *A. Patzelt, I. Edwards, S.Knees, S. Laser, A. Miller, L. Morris & D. Rae* 2688 (holotype SQU; isotypes E, K).

Description: Low shrub, forming cushions, up to 40 cm, branched from base, spiny. Stems and branches grey-brown, finely pubescent with spreading or erect hairs. Leaves opposite, 11–25 × 8–15 mm, suborbicular or broadly oblong to broadly ovate, apex rounded with a spinose mucro, base tapering into a short petiole 1–3 mm long, margins entire, glabrous to sparsely white pubescent along the margins and main veins and scattered orange-brown glands towards the base. Axillary spines 4-armed from a common stalk; spines 5–35 mm. Inflorescence terminal, spiny. Flowers solitary in the axils of bracts, subtended by 2 bracteoles, those at the base sometimes subtended by a sessile or short-stalked 1–4-armed spine; bracts similar to leaves, triangular ovate to oblong-ovate or orbicular. Bracteoles inconspicuous, ovate, spinescent or reduced to a short spinule. Calyx grey-green, 4-lobed, 8–12 mm, lanceolate with a spinescent tip. Corolla straw-yellow to orange, tubular, 2-lipped, with 4 lobes in the upper lip, one lower lobe; tube narrow, ± 35 mm; lobes 5–8 mm, broadly ovate, rounded, retuse or apiculate at apex. Stamens 2 fertile; staminodes 2, included. Capsule 12–14 mm, ellipsoid, beaked, glabrous, 2-seeded.

Flowering and fruiting: September, October; capsule ripening November, December.

Distribution and habitat: Southern Oman, Dhofar, restricted to the north-facing and steep wadi slopes on the summit plateau of Jebal Semhan, on cliffs and amongst rocks. *Altitude*: ± 1400 m. Endemic to Dhofar, so far recorded only from Jebal Semhan.

Distribution map & Illustration: 765.

7. ***Barleria almughsaylensis*** Mosti, Raffaelli & Tardelli, Candollea 66(1): 192 (2011). Type: Oman, Dhofar, Al Mughsayl, 15 Nov. 2006. *M. Raffaelli, M. Tardelli & S. Mosti* s.n. (holotype FT).

Description: Low shrub to 40 cm, spiny. Stems decumbent, grey-green, white-pubescent. Leaves grey-green, opposite, 10–16 × 6–10 mm, elliptic to ovate-elliptic, base cuneate, apex mucronate, margins entire, white-pubescent; petiole ± 4 mm. Axillary spines 15–25 mm, with 2–3 smaller lateral spines 3–4 mm long. Flowers in congested terminal heads; bracts absent. Bracteoles close together and overlapping, 25–35 mm, with spiny marginss, apex ending in a long spine to 15 mm. Outer calyx lobes ± 10 × 8 mm, broadly ovate, distinctly nerved, margins with smaller weak spines, pubescent; inner lobes 6–7 mm, linear-lanceolate, densely hairy. Corolla white tinged with blue; corolla tube ± 60 mm, pubescent outside; lobes ± 7 mm, rounded. Capsule and seeds not seen.

Flowering & fruiting: ?September/October.

Distribution and habitat: Southern Oman, rocky slopes and on coastal cliffs on Jebal Qamar, near Khor Mughsayl. *Altitude*: ± 100 m. Not known elsewhere.

Distribution map & Illustration: 766.

Notes: Known only from Khor Mughsayl and apparently endemic to Dhofar but may occur in the neighbouring Al Mahra region. *Miller* 2776 is referable to this species.

6. **Lepidagathis** Willd.

About 100 species found in tropical Africa to South Africa; tropical Asia to Australia, Caribbean and Mesoamerica to Peru and Brazil.

Lepidagathis calycina Hochst. ex Nees in DC., Prodr. 11: 252 (1847).

Description: Woody based perennial herb, up to 30 cm. Stems erect to ascending to decumbent, pubescent. Leaves opposite, sparsely pubescent, 12–42 × 12–20 mm, ovate to elliptic-ovate, apex obtuse, margins entire to irregularly crenulate, base rounded; petiole 3–7 mm. Flowers in congested axillary spikes; bracts overlapping, 8–10 mm, ovate, green with scarious marginss, midrib drawn into an acuminate tip; bracteoles ± 5 mm. Calyx ± 3 mm, pubescent, unequally 4-lobed, upper lobe lanceolate, up to 10 mm, lower lobe ± 10 mm, divided to half its length, lateral lobes ± 7 mm, narrow lanceolate. Corolla white or yellowish with purple markings in throat, tube ± 6 mm; upper lip ± 5 mm, 2-lipped; lower lip ± 6 mm, 3-lobed. Stamens 4; anthers of the lower stamens 2-celled, slightly displaced; the upper 1-celled. Capsule 7–8 mm, 4-seeded.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, in the escarpment mountains, at edges of *Anogeissus* woodland. *Altitude*: ± 900 m. Distributed in East and northern eastern Africa, Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 767.

7. **Neuracanthus** Nees

About 30 species distributed in tropical Africa to South Africa, Madagascar, S Arabia and India to Thailand.

Conspicuous sterile spiny inflorescences present; fertile bracts woolly at the base .... 1. **N. robecchii** subsp. **atratus**
Sterile spiny inflorescences absent; fertile bracts pubescent throughout ..... 2. **N. spinosus**

1. ***Neuracanthus robecchii*** (Lindau) C.B.Clarke, Fl. Trop. Afr. 5: 140 (1899).
Basionym: *Leucobarleria robecchii* Lindau (1896).

subsp. ***atratus*** Bidgood & Brummitt, Kew Bull. 53(1): 67 (1998).

Description: Woody based annual or perennial herb, up to 25 cm. Stems grey-white, mostly procumbent or ascending, white-tomentose. Leaves opposite, 32–60 × 8–28 mm, narrow obovate to oblanceolate, grey-green beneath, margins irregularly crenulate, apex obtuse or emarginate , base tapering into the petiole to 30 mm long. Flowers in spiny axillary spikes; bracts overlapping, each supporting a sessile or subsessile flower 5–10 mm, bracts broadly ovate to ovate with a spiny acuminate tip; branched spines representing sterile inflorescences. Calyx deeply divided into 2 lobes, both enlarging in fruit; upper lobe 6–9 mm, 3-veined; lower 5–6 mm, 2-veined. Corolla blue to purple or white 6–8 mm; tube short, limb 3–5 mm across. Capsule 6–8 mm, ovoid, glabrous.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, in the escarpment hills, on slopes and rocky areas, with *Euphorbia balsamifera, Commiphora, Boswellia sacra* and *Croton*. *Altitude*: 50–850 m. Distributed in northern Somalia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 768.

Notes: The type subspecies *robecchii* differs from subsp. *atratus* in its wider leaves and longer fertile inflorescences.

2. ***Neuracanthus spinosus*** Deflers, Bull. Soc. Bot. France 43: 222 (1896).
Type: Yemen, *Deflers* 383 (lectotype P; isolectotype G).

Description: Shrub up to 50 cm. Stems greyish-white, decumbent or ascending, branching from the base, white tomentose. Leaves opposite, dull green above, grey-green beneath, white tomentose when young, glabrescent with age, 15–30 × 10–15 mm, narrow ovate to oblanceolate, margins entire, ± sinuate, apex obtuse, base tapering into the petiole to 20 mm long. Flowers in axillary clusters; spiny inflorescences axes absent; bracts white lanate when young, 5–6 × 2–4 mm, lanceolate. Calyx deeply divided into 2 lobes, both enlarging in fruit, 6–7 mm, lanceolate with a spiny apex. Corolla pale blue to purple, white in centre, funnel-shaped, ± 10 mm, hairy outside. Capsule ovoid, 10–11 mm, hairy.

Flowering and fruiting: August to October.

Distribution and habitat: Southern Oman, Dhofar, in the escarpment hills, on slopes, rocky areas and grassland with *Acacia, Commiphora, Euphorbia, Dracaena*. *Altitude*: 30–1200 m. A regional endemic, elsewhere known only from Yemen.

Distribution map & Illustration: 769.

8. **Dicliptera**

About 150 species distributed in tropical and subtropical Africa to South Africa and Madagascar, Arabia, Pakistan and India, S China to Taiwan and through tropical Asia to Australia.

Dicliptera paniculata (Forssk.) I.Darbysh., Kew Bull. 62(1): 122 (2007).
Basionym: *Dianthera paniculata* Forssk. (1775). Type: Yemen, *Forsskal* 385 (lectotype C; microfiche 38: III 3–4 (K).
Synonym: *Peristrophe paniculata* (Forssk.) Brummitt (1983).

Description: Woody based annual herb, up to 1 m. Stems glabrous to pubescent, branched, angular. Leaves opposite, 8–12 × 3–4 mm, decreasing in size upwards, oblong-lanceolate to narrowly elliptic, margins entire, apex acute, base rounded to attenuate, ± pubescent; petiole 1–2 mm. Flowers in lax axillary paniculate cymes; bracts 2, unequal, linear-lanceolate, ± 10 mm, subtending 2 flowers; bracteoles 2, subtending the flower, 4–5 mm, lanceolate. Calyx 3–4 mm, lobes linear with a narrow hyaline margins. Corolla pale purple to pinkish, 2-lipped, tube ± 5 mm, twisted; lower lip ± 7 mm, with 3 teeth at the apex; upper lip with a rounded tip, reflexed at maturity. Stamens 2; anthers 2-celled with one cell above the other. Capsule 8–9 mm, 4-seeded.

Flowering and fruiting: September.

Distribution and habitat: Southern and northern Oman (in northern Oman, a single record from Nizwa, *Radcliffe-Smith* 3889 at K, at edge of cultivation), in the foothills and escarpment hills, beside tracks; not very common. *Altitude*: 200–800 m. Widespread in tropical and subtropical Africa, from Cape Verde and Mauritiana east to Egypt and Ethiopia and south to Namibia and Zimbabwe, Arabia and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 770.

Notes: Reported from Al Ain, UAE by Karim and Fawzi, *Flora of the United Arab. Emir.* 2: 214 (2007).

9. **Hypoestes** Sol. ex R.Br.

About 150 species distributed in tropical Africa to South Africa and Madagascar, India, tropical Asia to Australia; also Indian Ocean Islands.

Hypoestes forskaolii (Vahl) R.Br., Voy. Abyss. App. 53 (1814), as 'forskålei'; Bot. Macaronesica, 6: 64 (1980), as 'forskalei'.
Basionym: *Justicia forskaolii* Vahl (1790), as "forskalei".
Vernacular name: herum axali.

Description: Perennial, woody based herb, up to 70 cm. Stems erect to straggling, branched, crisped-pubescent. Leaves opposite, 20–55 × 10–35 mm, ovate to ovate-elliptic to lanceolate, glabrous to finely puberulous, margins entire, apex acute, base rounded or unequal; petiole 5–30 mm. Flowers in congested terminal and axillary cymes; bracts ± 7 mm, joined below, enclosing the calyx, glandular tomentose. Calyx 3–4 mm, 5-lobed to about ½ the length, lobes lanceolate, tomentose. Corolla pale pink or white with dark purple markings in throat, 2-lipped, tubular below; tube ± 10 mm, twisted; upper lip shallowly 3-lobed at the apex, reflexed, lower lip ± 7 mm, with a long central and rounded lateral lobes. Stamens 2, exserted; anthers 1-celled. Capsule ± 7 mm, fusiform, apically hairy, 4-seeded. Seeds circular, smooth.

Flowering and fruiting: August to September, and sporadically throughout the year.

Distribution and habitat: Southern Oman, Dhofar in the escarpment woodland, in *Acacia–Commiphora* scrub and *Anogeissus* woodland. *Altitude*: 350–1200 m. Widespread in tropical and southern Africa, also NE Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 771.

Notes: The plant is reported to be poisonous to livestock and can be fatal.

10. **Ruttya** Harv.
Six species distributed from southern Arabia, Ethiopia, Somalia to South Africa and Madagascar.

Ruttya fruticosa Lindau, Bot. Jahrb. 20: 45 (1895).
Vernacular names: tur iyyel, mughelif.

Description: Shrub or small tree up to 3 m. Young stems often pendant, grey-brown. Leaves opposite, elliptic to ovate, 4–12 × 2–5 mm, apex acute, base tapering into the petiole, margins entire or irregularly crenate, glabrous with cystoliths; petiole 1–2 cm. Flowers in 5–10-flowered terminal cymes; bracts and bracteoles linear. Calyx 4–6 mm, lobes acute. Corolla orange-red with a black wrinkled throat, 2-lipped, lower lip 3-lobed, forming a lower and 2 lateral lobes, lobes ovate, 18–20 mm, upper lip ovate, deeply bilobed, 15–20 mm, corolla tube ± 10 mm. Stamens 2, exserted, held under upper lip; staminodes 2; anthers 1-celled. Capsule clavate, 35–40 mm, 4-seeded, glabrous.

Flowering and fruiting: September to November.

Distribution and habitat: Southern Oman, Dhofar, in the escarpment woodlands, on the seaward facing hill slopes, beside seasonal streams, with *Anogeissus*, *Delonix* etc. *Altitude*:

500–800 m. Widespread in eastern tropical Africa (Djibouti, Ethiopia, Somalia, Kenya, Tanzania). Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 772.

11. **Ecbolium** Kurz

About 22 species distributed from tropical Arabia, Sudan to Somalia, to Angola and south to South Africa and Madagascar.

Ecbolium viride (Forssk.) Alston, Handbk. Fl. Ceylon 6: 229 (1931).
Basionym: *Justicia viridis* Forssk. (1775). Type: Yemen, Wadi Sordud, 1763, *Forsskal*, s.n. (lectotype BM).

Description: Perennial woody based herb or shrub up to 1 m. Stems herbaceous above, green, glabrous to puberulous. Leaves dark green, up to 6 × 15 cm, broadly lanceolate, margins entire, apex acute, base tapering into a short petiole, glabrous to pubescent. Flowers in terminal spikes; bracts overlapping, pale green, 10–11 mm, ovate, apex shortly acuminate, midrib distinct. Calyx 3–7 mm. Corolla greenish to pale yellow-green, tubular, lobed above; tube ± 25 mm; lobes 13–18 mm, the lower 3 spreading, upper lobe emarginate. Capsule 18–24 mm, glabrous, 2-seeded.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, in the Hajar mountains, in wadis, on cliff ledges, and cultivated areas, near springs, streams and water channels. *Altitude*: 300–600 m. Distributed in Ethiopia, Eritrea, Djibouti, Sudan, Somalia, Kenya and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 773.

12. **Megalochlamys** Lindau

About 10 species distributed from tropical Arabia, Sudan to Somalia to Angola and south to South Africa.

Megalochlamys violacea (Vahl) Vollesen, Kew Bull. 44(4): 608 (1989).
Basionym: *Dianthera violacea* Vahl (1790). *Synonym*: *Ecbolium violaceum* (Vahl) Hilleoat & J.R.I.Wood (1983).

Description: Perennial, woody based herb or low shrub, up to 1 m tall. Stems branched, grey-green, young stems adpressed pubescent. Leaves 18–40 × 8–18 mm, ovate to ovate-lanceolate, apex acute to rounded, base cuneate tapering into a short petiole, margins entire, somewhat sinuate; leaves ± glabrous to puberulous. Flowers in terminal spikes; bracts overlapping, green, 8–11 mm, ovate, apex shortly acuminate, midrib distinct, ciliate at the apex. Calyx 3–5 mm. Corolla pale pink to blue, tubular, lobed above; tube 5–8 mm; lobes 6–12 mm, entire. Capsule ovoid, 8–12 mm, 2-seeded. Seeds smooth, glossy.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the dry escarpment hills, and on gravel and rocky plains. *Altitude*: 50–1000 m. Distributed in Ethiopia, Eritrea, Djibouti, Sudan, Somalia and Kenya. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 774.

13. **Justicia** L.

About 600 species distributed mainly in the tropics from the Arabian Peninsula to South Africa; W Indian Ocean Islands; tropical Asia to Australia; also E Canada to Argentina.

1. Shrub to 1.5 m; leaves up to 8 × 3 cm; calyx 16–17 mm ..... 1. **J. areysiana**
   Undershrubs to 40 cm; leaves usually much smaller than 8 × 3 cm; calyx 2–4 mm 2
2. Capsule of 2 kinds, 4-seeded ellipsoid and 1-seeded ± rounded with dentate edges ... . 3. **J. heterocarpa**
   Capsule of one kind only 3
3. Stems trailing to decumbent; leaves orbicular to broadly ovate; calyx 4-lobed, green with ciliate hyaline margins ..... 2. **J. diffusa**
   Stems ± erect; leaves various, from ovate to lanceolate; calyx 5-lobed, with or without ciliate margins 4
4. Bracts suborbicular to broadly ovate with lanate margins; flowers in short axillary and terminal congested spike-like inflorescence ..... 5. **J. debilis**
   Bracts not as above; flowers in axillary spikes 5
5. Corolla yellow; bracts ± 1 mm ..... 4. **J. odora**
   Corolla blue; bracts 7–9 mm ..... 6. **J. parviflora**

1. ***Justicia areysiana*** Deflers, Bull. Soc. Bot. France 43: 225 (1896).

Type: Yemen, Jebal Al-Areys (Bil Fodhli), *Deflers* 956 (holotype ?P).

Synonyms: *Bentia fruticulosa* Rolfe, Kew Bull. 1894: 338–339 (1894) non *Justicia fruticulosa* Lindau; . Type: Yemen, *Lunt* 221 (holotype K); *Justicia bentii* V.A.W.Graham, Kew Bull. 43(4): 585 (1988). Type as for *Bentia fruticulosa* Rolfe; *J. calyculata* sensu Ghazanfar (1992:15) non Deflers.

Description: Shrub, up to 1.5 m. Stems much branched, brown. Leaves opposite, ovate to elliptic, 1–8 × 1–3 cm, apex acute, base tapering into a sessile base, margins entire, glabrescent. Flowers arranged in terminal spikes subtended by a bract and 2 bracteoles; bracts and bracteoles ± 15 mm, obovate with broad scarious margins. Calyx 16–17 mm, 4-lobed almost to the base; lobes lanceolate. Corolla 2-lipped, white with a brown throat; lower lip ± 15 mm, with 3 teeth at the apex; upper lip ± 15 mm, hooded. Stamens 2. Capsule ellipsoid, ± 20 mm, 4-seeded, pubescent. Seeds smooth.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, in the escarpment woodlands, on thickly wooded slopes, edges of pools, with *Anogeissus*, *Ficus*. *Altitude*: 50–500 m. A regional endemic, elsewhere in the Arabian Peninsula found in Yemen (Hadramaut, Al Mahra).

Distribution map & Illustration: 775.

Notes. The species is illustrated in Miller & Moris, Pl. Dhofar 1988: 4 as *Bentia fruticulosa*. Browsed by camels.

2. ***Justicia diffusa*** Willd. in L., Sp. Pl., ed. 4: 87 (1797).

Description: Woody based perennial herb, up to 15 cm. Stems prostrate and trailing or erect, lateral branches decumbent, tinged purple-red. Leaves opposite, dark green tinged red, 5–11 × 5–12 mm, orbicular to broadly ovate, apex acute, base rounded, margins entire to minutely crenulate; petiole 1–2 mm. Flowers in terminal spikes on side branches; bracts and bracteoles 2, ± 3 mm, ovate with scarious margins, overlapping. Calyx ± 4 mm, 4-lobed, green with scarious margins, ciliate. Corolla 2-lipped, white to pinkish with purple markings, lower lip ± 3 mm, with 3 teeth at the apex, upper lip ± 3 mm. Stamens 2; anthers displaced, the lower with a basal appendage. Capsule ellipsoid, ± 4 mm, 2–4-seeded.

Flowering and fruiting: September to January.

Distribution and habitat: Southern Oman, Dhofar, from sea level to the escarpment hills, in mixed dense thickets, dry open and disturbed places, coastal plains, roadsides and clearings. *Altitude*: 10–800 m. Widely distributed from Australia to Pakistan, Arabia and Ethiopia west to Nigeria. Elsewhere in the Arabian Peninsula found in ?Saudi Arabia, ?Yemen.

Distribution map & Illustration: 776.

3. ***Justicia heterocarpa*** T.Anderson, Proc. Linn. Soc. Bot. 7: 41 (1864).

Description: Woody based perennial herb, up to 30 cm. Stems branched, leafy, erect to ascending. Leaves opposite, 15–40 × 8–20 mm, pubescent, lanceolate to elliptic to ovate, apex acute, base rounded, margins entire; petiole 5–10 mm, densely pubescent. Flowers 3–5, in opposite axillary clusters; bracts ± 3 mm, with simple and glandular hairs. Bracteoles up to 1 mm. Calyx ± 3mm (elongating to 5 mm in fruit), deeply 5-lobed, lobes linear-subulate, simple and glandular hairy, margins hyaline. Corolla 2-lipped, pale purple with purple markings; lower lip 3–4 mm, 3-lobed above; upper lip ± 2 mm, oblong, notched apically. Stamens 2; anthers displaced, the lower with a basal appendage. Capsule of two kinds: ellipsoid, ± 3.5 mm, 4-seeded; ± rounded with dentate edges, indehiscent, 1-seeded.

Flowering and fruiting: September.

Distribution and habitat: Northern Oman in Musandam, and Southern Oman, Dhofar, in dry rocky places, disturbed sites, often growing in rock crevices and amongst rocks, in *Acacia-Commiphora* scrub. Not recorded from the Hajar mountains but perhaps misidentified or overlooked. *Altitude*: 250–900. Widespread in eastern tropical Africa, Egypt, Somalia,

Ethiopia, tropical Arabia to Pakistan and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 777.

4. ***Justicia odora*** (Forssk.) Lam., Encycl. I: 629 (1785).
Basionym: *Dianthera odora* Forssk. (1775). Type: Yemen, Sordoud, 1753, *Forsskål* 384, (C, microfiche 38: III 1, 2).

Description: Woody based perennial herb, up to 10 cm, somewhat aromatic (aromatic when dry). Stems erect to ascending, glabrous to pubescent. Leaves opposite, glabrous to pubescent, 5–20 × 4–12 mm, obovate to oblong-elliptic, apex obtuse, acuminate to emarginate at apex , base rounded to cuneate, margins entire; petiole 2–5 mm. Flowers 1–3, in the upper axils of leaves; bracts and bracteoles ± 1 mm. Calyx ± 3 mm, 5-lobed, lobes lanceolate, sparsely to pubescent. Corolla 2-lipped, yellow, often with reddish veins; lower lip ± 8 mm, 3-lobed; upper lip ± 7 mm, oblong, notched apically, hooded. Stamens 2; anthers displaced, the lower with a basal appendage. Capsule ± 10 mm, ellipsoid, glabrous to pubescent, 2-seeded.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains and foothills, with *Delonix*, *Croton*, *Commiphora*, and in somewhat drier areas. *Altitude*: 100–900 m. Distributed in tropical eastern and north-eastern Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 778.

5. ***Justicia debilis*** (Forssk.) Vahl, Symb. 2: 15 (1790).
Basionym: *Dianthera debile* Forssk. (1775). Type: Yemen, Taizz, *Forsskal* 391 (C– microfiche 38: II. 3,4.).
Synonym: *Monechma debile* (Forssk.) Nees in DC. (1847).

Description: Woody based annual or perennial herb, up to 25 cm, crisped pubescent. Stems branched from the base, erect to decumbent. Leaves opposite, pubescent, 15–40 × 7–11 mm, broadly lanceolate to elliptic, apex acute to obtuse, margins entire, base tapering into a short petiole ± 10 mm. Flowers in short axillary and terminal congested spike-like inflorescences; bracts 5–12 mm, suborbicular to broadly ovate, sessile, margins lanate. Calyx 5-lobed, lobes ± 2 mm, narrow triangular, green, densely pubescent. Corolla 2-lipped, reddish-purple with purple markings on lower lip, ± 10 mm; tube ± 6 mm; upper lip ± 5 mm; lower lip ± 5 mm. Stamens 2; anthers displaced, the lower with a basal appendage. Capsule 5–6 mm, ellipsoid, 2-seeded.

Flowering and fruiting: August to October.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment woodland, and rocky grassland, with *Delonix*, *Commiphora*, *Anogeissus* and *Acacia*. *Altitude*: 250–500 m.

Distributed in north-east and eastern tropical Africa. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 779.

6. ***Justicia parviflora*** (Nees) Lindau in Engl. & Prantl., Nat. Pflanzenf. 4 (Abt. 3b): 350 (1895).
Basionym: *Rungia parviflora* Nees (1832).

Description: Annual herb up to 40 cm. Stems erect, angular, pubescent especially on the angles. Leaves bright green, opposite, 15–55 × 8–25 mm, elliptic to ovate-lanceolate, margins entire, apex acute, base cuneate, pubescent on both surfaces; petiole 5–15 mm. Flowers in axillary spikes; bracts overlapping, 7–9 mm, green with broad white scarious margins, pubescent and ciliate. Calyx ± 3 mm, lobes linear. Corolla pale blue, 2-lipped, about as long as the bracts, the lower lip pubescent outside. Stamens 2; anthers displaced, the lower with a basal appendage. Capsule ± 2 mm, sparsely hairy, exserted from the calyx.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, on the plateau grasslands and escarpment hills, in *Anogeissus* woodland. *Altitude*: 150 -800 m. Distributed from India and Sri Lanka to China and Hong Kong. Elsewhere in the Arabian Peninsula found in Yemen (S).

Distribution map & Illustration: 780.

Species doubtfully recorded

Isoglossa punctata (Vahl) Brummitt & J.R.I.Wood has been reported from Dhofar, but I have not seen any material of the species; it is reported to be rare in Yemen (N).

84. **Pedaliaceae**

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Sesamum L.
About 30 species distributed from tropical Africa to South Africa and tropical Asia; widely cultivated and naturalised in many warm regions.

Sesamum indicum L., Sp. Pl.: 634 (1753).
Vernacular names: juljulaan; simsim. English name: sesame

Description: Annual herb; stems erect 30–50 cm, pubescent. Lower leaves opposite, ovate-oblong, trilobed, lobes oblong, with entire or dentate margins; upper leaves alter-

nate, oblong to linear-lanceolate, base tapering, apex acute, margins entire; petiole 1–2 cm. Flowers solitary in the axils of leaves; pedicels 1–2 mm, pubescent. Sepals 5, lobed almost to base, lobes 3–5 mm, lanceolate, acute, pubescent. Corolla whitish or pinkish with red or yellow marks, tubular, 5-lobed above; tube 15–17 mm, ± campanulate, pubescent outside; limb bilabiate, with a large lower lobe ± 15 mm, rounded acute; upper and lateral lobes ± 10 mm, rounded, acute to abruptly shortly acuminate. Stamens 4, two long and two short, fifth obscure, included. Capsule 22–25 mm, oblong, 4-locular, splitting by 2 valves. Seeds oblong, many.

Flowering and fruiting: September to October.

Distribution and habitat: Southern and Northern Oman, cultivated in private farms and gardens; sometimes found as an escape. *Altitude*: 10–150 m. Native to tropical Asia, but introduced and cultivated in many parts of the world including S Europe, Tropical Africa, the Middle East, S Asia, China and elsewhere. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 781.

Notes: Bedigian (citations above) has shown that sesame was first domesticated in India; more recently archeological evidence of its cultivation between 2250 and 1750 BC has been found at Harappa in the Indus Valley, and during the second half of the 3rd millenium in Miri Qalat, Makran, Baluchistan. Sesame oil and seeds have been used in the Middle East as food and medicine since ancient times and continue to do so today.

85. **Bignoniaceae**

Tecomella Seem.
A single species distributed from Arabia, Iran, E Afghanistan to Pakistan and W India.

Tecomella undulata (Roxb.) Seeman, Ann. Mag. Nat. Hist. Ser. 3, 10: 30 (1862).
Basionym: *Bignonia undulata* Roxb. (1832). *Synonyms*: *Tecoma undulata* (Roxb.) G. Don (1838); *Bignonia glauca* Decne. (1841–1844).
Vernacular name: farfar, ferfar. English name: Rajisthan teak.

Description: Small tree, 2.5–6 m tall. Leaves pale green, opposite, 22–75 × 5–15 mm, linear-oblong to elliptic oblong, apex obtuse or emarginate, base tapering, margins entire, undulate; petiole 5–10 mm, pale yellow-green. Flowers large and showy, in 1–8-flowered condensed racemes; bracts linear, stellate pubescent; bracteoles 2; pedicel 7–12 mm, pubescent. Calyx 8–12 mm, campanulate, unequally 5-lobed; lobes obtuse, apiculate, minutely and sparsely glandular-pubescent. Corolla bright orange to orange, 50–60 mm, funnel-shaped; tube 28–30 mm, lobes 20–25 mm, suborbicular. Stamens 4; staminodes shorter than stamens. Disc cupular, 5-lobed; style beyond the stamens; stigmas 2, compressed. Capsule 17–34 × 1–1.2 cm, linear-oblong, laterally compressed, slightly curved, apex beaked with 20 mm broad wing.

Flowering and fruiting: February to May; fruit not seen.

Distribution: Northern Oman, in the foothills of the Hajar mountains, in silty and rocky places, hill sides, usually near villages and abandoned date plantations, edges of wadis, dry and gravely wadi beds, often near water and falajs. *Altitude*: 350–500 m. Distributed in S Iran, Afghanistan, Pakistan & NW India. Elsewhere in the Arabian Peninsula found in UAE.

Distribution map & Illustration: 782.

Notes: The plant is possibly introduced due to its fire resistant wood, and bark that is recorded to have medicinal properties, but is now naturalized. The isolated clumps found near habitations are probably remnants of old cultivations. The leaves are used as fodder for goats. I have not seen the tree set seed in Oman (or the UAE) (possibly because of lack of pollinators); it is usually propagated by root offsets.

Cultivated species

Tecoma stans (L.) Kunth and ***T. alata*** DC.

Tecoma stans (Yellow trumpet flower) is a large bush with yellow flowers and bright green dentate leaves, and is commonly cultivated in private homes and public parks. It is moderately tolerant to salinity and drought. *Tecoma alata* is less vigorous and has orange flowers. It is also commonly cultivated in private homes.

Spathodea campanulata (African Tulip tree) is a tree to 10 m with showy reddish-orange flowers and bright green ovate leaves. It is not commonly cultivated in Oman and I have not seen it public parks.

86. **Lentibulariaceae**

Bibliography

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Utricularia L.

Some 200+ species, cosmopolitan in distribution with the majority in tropical and subtropical regions.

Floating; leaves divided into segments ..... 1. **U. australis**
Epiphyte; leaves obovate, not divided ..... 2. **U. striatula**

1. ***Utricularia australis*** R.Br., Prodr.: 430 (1810).

Description: Perennial aquatic, floating. Rhizoids few, filiform. Stolons filiform, glabrous, branched, up to 8 cm (in Oman specimen), internodes 10 mm. Leaves many, primary segments pinnately divided, secondary dichotomously divided into many segments, the ultimate segments ± flattened, filiform. Traps dimorphic, lateral, ovoid, with a short stalk ± 2 mm, mouth lateral with 2 simple or branched dorsal appendages; basal traps ovoid, with a basal mouth; internal glands 2- and 4-armed. Inflorescence (not seen) weakly erect,

peduncle filiform, glabrous. Scales present in the upper half of the peduncle; bracts ± circular. Calyx 2-lobed, lobes ± equal, 2–3 mm. Corolla bilabiate, yellow, ±10 mm; upper lip broadly ovate; lower lip reniform to transversely elliptic, the base with a prominent swelling. Capsule globose (not seen)

Flowering and fruiting: ?September.

Distribution and habitat: Southern Oman, Dhofar, in wadis, in permanent water pools. *Altitude*: ± 600 m. Europe, temperate Asia to China and Japan,, tropical and South Africa, tropical Asia, Australia and New Zealand. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 783.

Notes: Only a single collection from Oman, from Wadi Andhur from a permanent pool. A collection from the fresh water pool at Wadi Hinna and another from a small pool near Khawr Mughsayl are possibly this species, though the material is not good enough for proper identification. On the National Red List it is assessed here as Data Deficient.

2. ***Utricularia striatula*** Sm. in Rees, Cyclop. 37: No. 17 (1819).
Synonym: *Utricularia orbiculata* Wall. (1829) & ex A.DC. (1844).

Description: Annual, very small up to 5 cm, epiphytic on trees or rocks. Rhizoids few, capillary. Stolons filiform, glabrous, simple, radiating from the base of peduncle. Leaves many, rosulate from the peduncle base and on stolons, up to 5–8 mm long, 1–3 mm wide, obovate, apex rounded, base tapering into the petiole. Traps lateral, on rhizoids and stolons, ovoid, with a short stalk ± 1 mm, mouth lateral with a dorsal deeply bifid appendage, the distal margin of appendage with multicellular stipitate glands. Inflorescence a raceme, erect, peduncle filiform, ± 3 cm, glabrous; bracts ± 1 mm, narrowly ovate or oblong, margins irregularly crenate, glandular. Calyx 2-lobed, lobes unequal, 1.5–2 mm, upper lobe ± circular, lower lobe smaller, oblong-elliptic. Corolla bilabiate, white (on herbarium label), or ± tinged violet and with a yellow spot at base of lower lip, 4–5 mm; upper lip ovate with shortly bifid apex, lower lip ± circular, apex shortly 5-lobed; palate fringed with hairs, spur about as long as the lower lip. Capsule globose, obliquely compressed, keeled on the ventral surface, dehiscing by a single ventral slit.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in moist, shaded locations, epiphytic on trees; not common. *Altitude*: ± 800 m. Distributed from Africa east to Papua New Guinea. Not recorded elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 784.

Notes: There is only a single collection from Jebal Qara, epiphytic on *Euclea schimperi*. It is reportedly rare or not often collected throughout its range of distribution. On the National Red List it is assessed here as Data Deficient.

87. **Campanulaceae**
(incl. Lobeliaceae)

Bibliography

Thulin, M. (1975). The genus *Wahlenbergia* s.lat. (Campanulaceae) in tropical Africa and Madagascar. *Symb. Bot. Upsal.* 21(1): 1–223.

The well defined subfamily, Lobelioideae characterized by highly irregular, resupinate flowers and united anthers is treated as a separate family Lobeliaceae in the APG III (2009) classification (Oman flora *Lobelia*).

Key to the genera of Campanulaceae in Oman

1. Flowers zygomorphic, resupinate; corolla 2-lipped; anthers united into a tube ..... 3. **Lobelia**
   Flowers actinomorphic; corolla with equal lobes; anthers free 2
2. Corolla deeply divided, petals almost free (in Oman); capsule dehiscing by apical valves ..... 1. **Wahlenbergia**
   Corolla campanulate, 5-lobed; capsule dehiscing laterally ..... 2. **Campanula**

1. **Wahlenbergia** Schrad. ex Roth (*nom. conserv.*)

About 700 species found especially in the Mediterranean region and South Africa.

Wahlenbergia flexuosa (Hook.f. & Thoms.) Thulin, Symb. Bot. Upsal. 21(1): 158 (1975).
Basionym: *Cephalostigma flexuosum* Hook.f. & Thoms. (1857).

Description: Annual herb, 5–30 cm; stems simple or with few branches, slender, erect, hirsute with long hairs throughout. Leaves dull green, 8–25 × 5–15 mm, ovate to broadly ovate or elliptic, base unequal, sessile, apex acute obtuse, margins irregularly dentate, undulate. Flowers in a lax panicle; pedicels 10–30 mm. Calyx 5-lobed to about half its length, lobes 1–3 mm, lanceolate, hirsute. Corolla yellow, deeply 5-lobed with lobes almost free, 1.5–3 mm. Ovary 3-celled, semi-inferior. Capsule 10-nerved with long hirsute hairs on the nerves, dehiscing by 5 valves.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in *Anogeissus* woodland and in grassland with *Euphorbia balsamifera*. *Altitude*: 650–900 m. Distributed from NE tropical Africa to Cameroon and south to Malawi; SW Arabia and India. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 785.

Notes: Even though this species is fairly widespread in tropical Africa, it is rare in southern Oman and has been recorded only a few times, and has not been collected in the last 15 years. Possibly overlooked as an annual in grassland, but perhaps grazed to extinction in this over-grazed grassland. On the National Red List it is assessed here as Data Deficient.

2. **Campanula** L.

Some 300 species widely distributed in the Mediterranean region and the Middle East.

Annual herb; stems erect, dichotomously branched ..... 1. **C. erinus**
Perennial herb; stems ± erect, not dichotomously branched ..... 2. **C. akhdarensis**

1. ***Campanula erinus*** L., Sp. Pl. 169 (1753).

Description: Annual slender herb, 8–12 cm. Stems erect, simple, dichotomously branched, with white patent hairs. Leaves bright yellow-green, sessile, ± opposite, 5–11 × 3–5 mm, ovate to obovate to broadly oblanceolate, base attenuate, apex obtuse, margins crenate to dentate, white pubescent, 3-nerved. Flowers terminal or axillary, at right angles to the stem, on short pedicels. Calyx campanulate, 5.5–6 mm; tube 1.5–2 mm, with triangular lobes, enlarging in fruit, white patent pubescent. Corolla pale blue, 8–9 mm, 5-lobed above, 4–5 mm across. Capsule ± 5 mm in diameter, nodding.

Flowering and fruiting: March, April.

Distribution and habitat: Northern Oman, and Musandam, in the foothills of the Western and Eastern Hajar mountains, in wadis and in sandy depressions, in shade amongst rocks. *Altitude*: 50–800 m. Distributed in the Mediterranean region, Ethiopia, Sudan, and SW Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia.

Distribution map & Illustration: 786.

Notes: Only known from two localities from the northern mountains, but possibly under-collected, as these have been collected after a season of good rain, which is not always of a regular occurrence. On the National Red List it is assessed here as Data Deficient.

2. ***Campanula akhdarensis*** Miller & Whitcombe, Edinb. J. Bot. 41(1): 109–113 (1983).

Type: Northern Oman, Jebal Akhdar, between An Nid and Masjid Mu'alla, 4 Oct. 1978, *R. Whitcombe* 379 (holotype E).

Description: Perennial herb, somewhat woody at the base. Stems slender, ± erect, branched up to 15 cm, white, hirsute becoming glabrous with age. Leaves alternate, 3–28 × 1–5(–8) mm, elliptic to narrow obovate, base attenuating into a small petiole, apex acute, margins ± dentate-crenate. Flowers 1–5, nodding in fruit. Calyx lobes 2–3 mm, acute, hirsute. Corolla bright blue to violet, 6–10 mm, tubular-campanulate, sparsely hairy outside. Stamens with filaments narrowly triangular, linear above, margins ciliate below. Capsule nodding, dehiscing by 3 valves.

Flowering and fruiting: August to October.

Distribution and habitat: Northern Oman, in the Western Hajar mountains, in the Jebal Akhdar range, on the Sayq plateau, and on summit of Jebal Kawr with *Juniperus*, *Dodonaea* and *Sageretia*, in shaded depressions and in rock crevices. *Altitude*: 1400–2900 m. Endemic and known only from the Western Hajar mountains.

Distribution map & Illustration: 787.

Notes: The plant is uncommon and has a very restricted distribution. It has been collected only a couple of times on Jebal Kawr and from the Jebal al Akhdar range of the Western Hajar mountains. In appearance it is most closely related to *C. incamescens* Boiss. from SW Iran and the Caucasus, being one of the several species found on the western Hajar mountains that floristically link northern Oman to SW Iran and Afghanistan. On the IUCN and National Red List it is assessed here as Data Deficient.

2. **Lobelia** L.

Some 1000 species distributed mainly in the tropics and subtropics, most numerous in the New World.

Lobelia heyneana Roem. & Schultes, Syst. Veg. 5: 50 (1819), as "heyniana".

Description: Annual herb. Stems slender, 5–20 mm, simple or with few branches from base, glabrous. Leaves pale green, 8–18 × 3–13 mm, ovate to broadly ovate to elliptic, base attenuating in to a short petiole 3–5 mm, apex acute, margins 5–6 dentate. Flowers in terminal and axillary racemes; pedicels slender, 10–15 mm; upper bracts lanceolate. Calyx yellow green; hypanthium, 8-nerved, glabrous, 2–4 mm, lobes ± 2 mm, lanceolate-linear, glabrous. Corolla pale blue, 3–4 mm, bi-lipped; upper lobe 3-lobed. Anthers whitish, united to form a tube, the 2 lower anthers with a tuft of hairs a the apex. Capsule ± 3 mm in diameter, ± 8-nerved.

Flowering and fruiting: September, October.

Distribution and habitat: Southern Oman, Dhofar, in grassland on the escarpment mountains in woodland dominated by *Anogeissus*, *Euclea*. *Altitude*: 500–850 m. Distributed in Ethiopia, Tanzania, Zambia, Congo (DR), and from India east to China. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 788.

Notes: This species is rare in southern Oman and has been recorded only a few times, and has not been collected recently. Possibly overlooked, but more likely disappeared due to over-grazing.

88. **Rubiaceae**

by Ghulam Sarwar & Shahina A. Ghazanfar

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Thulin, M. (1998). *Gaillonia* (Rubiaceae– Paederieae) in Africa and Arabia. *Nordic J. Bot.* 18(1): 31–38.

Nazimuddin , S. & Qaiser, M. (1989). Rubiaceae (No. 190), in E. Nasir & S.I. Ali (eds), *Flora of Pakistan* Karachi University, Pakistan.

Key to the genera of Rubiaceae in Oman

1. Leaves and leaf-like stipules in whorls of 4–10 2
   Leaves opposite, if in fascicles and appearing whorled, then distinct from stipules ... 5
2. Corolla 5-lobed; fruit a fleshy berry ..... 5. **Rubia**
   Corolla 3–4-lobed; fruit dry 3
3. Cymes 3-flowered, the central flower 4-merous, the laterals 3-merous; peduncle and pedicel coalescing and enlarging in fruit ..... 7. **Valantia**
   Cymes many-flowered, 4–5-merous; peduncle and pedicel separate 4
4. Bracts enlarged and enveloping the fruit; calyx limb ciliate ..... 4. **Callipeltis**
   Ultimate branches of inflorescence without bracts; bracts not enlarged; calyx limb obscure ..... 6. **Galium**
5. Leaves with distinct bacterial nodules seen as short black dots or lines on leaf surface ..... 9. **Pavetta**
   Leaves without bacterial nodules 6
6. Fruit splitting into 2, 1-seeded indehisecent mericarps, or with enlarged membranous wing-like calyx limb 7
   Fruit a capsule, not dehiscing into mericarps 8
7. Corolla hairy on throat and lobes ..... 2. **Pentodon**
   Corolla glabrous ..... 8. **Plocama**
8. Stamens and anthers included; stigma always below the anthers ..... 3. **Kohautia**
   Stamens included and anthers exserted or at mouth of corolla tube; stigma always above the anthers ..... 1. **Oldenlandia**

1. **Oldenlandia** L.

About 100 species pantropical in distribution, from Caucasus, Korea and Japan, SE USA, south to South Africa, Australia and Chile and Argentina.

Oldenlandia corymbosa L., Sp. Pl., ed. 1: 119 (1753).

Description: Annual herb up to 30 cm; stem erect to procumbent. Leaves opposite, 5–20(–40) × 1.5–4(–14) mm, linear to narrowly elliptic to ovate-elliptic, base cuneate, apex acute, margins entire, often recurved, glabrous to minutely scabridulous to papillose; stipules small, membranous, apex toothed. Flowers 1–4, axillary, isostylous; pedicel 3–8 mm. Calyx, 4-lobed, 1–3 mm, turbinate, persistent; lobes 1–2 mm, margins scabridulous. Corolla 4-lobed, white or purplish, 1–3 mm, funnel-shaped; lobes 1–2 mm, obtuse. Stamens 4, inserted at the mouth of the corolla tube, exserted. Style glabrous or sparsely hairy in the middle part. Capsule 1–3 mm in diameter, broadly ovoid, with adpressed hairs.

Two varieties in Oman:

Inflorescence 3–6 flowered; style glabrous ..... var. ***corymbosa***
Flowers mostly solitary at the nodes, or few in 2-flowered cymes; style sparsely hairy in the middle ..... var. ***caespitosa***

a. var. ***corymbosa***

Synonyms: *Oldenlandia biflora* Lam. (1786) (non L. 1753); *Hedyotis biflora* (Lam.) Roth. (1821).

Flowering and fruiting: April to June; September.

Distribution and habitat: Northern and southern Oman, distributed in the Jebel Akhdar range of the Hajar mountains, and in the escarpment woodlands in Dhofar, in thick undergrowth, and near and around cultivated areas and date gardens. *Altitude*: 100–500 m. Distributed from tropical Africa through Arabia to tropical Asia; also found in tropical America. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 789.

Notes: A widespread annual weedy species, variable in its vegetative characteristics. A collection from a date garden in the eastern Hajar, Siya (*Miller & Nyberg* 9584) has ovate to elliptic leaves (12–40 × 7–14 mm), but otherwise fits the description of var. *corymbosa*.

b. var. ***caespitosa*** (Benth.) Verdc., Kew Bull. 30: 298 (1975).

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, in stony and gravely, irrigated and cultivated places. *Altitude*: 100–550 m. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 790.

2. **Pentodon** Hochst.

Two species distributed in warm tropical parts of Africa, Arabia, Seychelles; one species in N America.

Pentodon pentandrus (Schumach.) Vatke, Oesterr. Bot. Zeit. 25: 231 (1875).
Synonym: *Hedyotis pentandra* Schumach. & Thionn. (1827).

var. ***pentandrus***

Description: Annual herb up to 35 cm; stems erect to procumbent. Leaves opposite, 20–40 × 5–15 mm, ovate-lanceolate, base cuneate, apex acute, margins entire, often inrolled, glabrous; stipules small, apex toothed. Flowers 1–4, axillary; pedicel slender, 5 mm. Calyx 4-lobed, 1.5–2 mm, turbinate, persistent; lobes 1–2 mm, acute. Corolla 4-lobed, white, 2–3 mm; lobes 1–2 mm, obtuse. Stamens 4. Capsule 3–4 mm in diameter, broadly ovoid, glabrous.

Flowering and fruiting: March/April.

Distribution and habitat: Northern Oman, in the foothills of the Hajar mountains, in wadis, in wet and shaded locations and in cultivated fields; localised and not common. Collection from Wadi Siya, *Ghazanfar* 973-SQUH is referable to this species. *Altitude*: 250–750 m. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 790.

3. **Kohautia** Cham. & Schltdl.
About 60 species, widespread from Egypt, Arabia and S Iran, Cape Verde and tropical Africa to South Africa, Madagascar and Mascarenes, Bangladesh and India to Sri Lanka.

Leaves opposite; flowers pale cream; capsule minutely tuberculate ..... 1. **K. caespitosa**
Leaves in fascicles; flowers purplish or whitish; capsule smooth, without tubercules ..... 2. **K. retrorsa**

1. ***Kohautia caespitosa*** Schnitzl., Flora 25, Beibl. 1:145 (1842) (incl. var. *schimperi* (Presl) Bremek.).

Description: Annual or perennial herb up to 35 cm; stems delicate, erect, branched. Leaves opposite, few on the stems, 10–25 × 1–3 mm, linear, sessile, apex acute, margins entire, ± glabrous. Flowers in loose cymes, spreading, sessile or subsessile. Calyx 4-lobed, turbinate; tube 1–1.5 mm, lobes 1–2 mm, triangular, ± glabrous. Corolla creamy, pinkish outside, sweet scented, with a long tube, 4-lobed above; tube 5–10 mm; lobes 3–4 mm, ovate, obtuse. Anthers inserted at the throat of the corolla tube, included. Stigma below the anthers. Capsule 2–3 × 1.5–3 mm, subglobose, minutely tuberculate.

Flowering and fruiting: February to May; September/October.

Distribution and habitat: Throughout Oman, on open gravely areas, low hillsides and coastal cliffs, wadi beds and around fields. *Altitude*: 40–1000 m. Distributed in Egypt, Sudan, Somalia, Eritrea and Arabia. Elsewhere in Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 791.

2. ***Kohautia retrorsa*** (Boiss.) Bremek., Verh. K. Nederl. Akad. Wet., Afd. Natuurk. ser. 2, 48 (2): 100 (1952).
Basionym: *Oldenlandia retrorsa* Boiss. (1875).
Vernacular names: silka; Harsusi; salaykit.

Description: Annual or perennial herb up to 60 cm, woody at base; stems di- to trichotomously branched, scabrid with retrorse hairs, ± glabrous above. Leaves in fascicles at the nodes, the upper opposite, 4–12 × 1–4 mm, linear-lanceolate to narrowly elliptic, sessile, apex acute, margins entire, hispid, with a prominent mid vein; stipules triangular, bidentate. Flowers in axillary and terminal cymes; pedicel 0.8–1.2 mm, elongating in fruit. Calyx 4-lobed, 1–1.5 mm long, glabrous; tube globose, lobes triangular, glabrous. Corolla 4-lobed, white or purplish; tube 10–15 mm, lobes 1–2 mm. Anthers inserted at the throat of the corolla tube, included. Stigma below the anthers. Capsule 2-lobed, 2–3 × 3–4 mm, glabrous, smooth and shining.

Flowering and fruiting: January to May; August/September.

Distribution and habitat: Throughout Oman, and Masirah Island, on dry gravel and sandy plains, dry wadi beds, in swales of low dunes, beside roads in desert areas; common annual after rain. *Altitude*: 20–800 m. Distributed in Pakistan and Arabia. Elsewhere in Arabian Peninsula found in UAE, Yemen.

Distribution map & Illustration: 792.

4. **Callipeltis** Stev.

Three species, distributed in Spain, N Africa and Arabia, Turkey, Caucasus to Tadzhikistan and Pakistan.

Callipeltis cucullaris (L.) Stev., Nouv. Mem. Soc. Imp. Nat. Mosc. 7: 275 (1829); DC., Prodr. 4: 613 (1830) as "cucullaria".

Basionym: *Valantia cucullaris* L. (1755). *Synonyms*: *Callipeltis cucullaris* (L.) Rothm. (1941); *C. cucullaris* (L.) Rothm. forma *aperta* (Boiss. et Buhse) Ehrend. (1958).

Description: Annual herb, 5–20 cm. Stems erect to ascending, branched, quadrangular, ± glabrous. Leaves in whorls of 4, 4–12 × 1–4 mm, oblong to spatulate, sessile, apex obtuse to acute, margins entire, scabrid or ± glabrous. Flowers in few-flowered clusters; bracts 3–6 mm, ovate to broadly obovate, membranous, white, prominently veined, usually folded lengthwise enveloping the fruit; pedicels 1–2 mm. Calyx 4-lobed, oblong, lobes ciliate. Corolla yellowish-green, 4-lobed, < 1 mm, campanulate. Stamens 4. Styles 2-fid; stigma 2-lobed. Fruit schizocarpic, 1–2 mm, oblong or cylindrical, slightly curved, hispid apically, with one seed developing.

Flowering and fruiting: February to May.

Distribution and habitat: Northern and Southern Oman and Musandam, on the summit, in silty and sandy depressions, amongst rocks and stones. *Altitude*: 1200–1400 m. Distributed from N Africa, Sinai and southern Arabia to Iran, Afghanistan and Pakistan, and from Spain, Turkey to Central Asia. Elsewhere in Arabian Peninsula found in Saudi Arabia, UAE.

Distribution map & Illustration: 793.

5. **Rubia** L.

About 60 species distributed in Macaronesia, Western Europe and the Mediterranean region to Japan, south to India and Malesia, Arabia, Sudan to Somalia and south to South Africa.

Rubia infundibularis Hemsl. & Lace, J. Linn. Soc. 28: 324 (1891).

Description: Perennial herb, woody at base with trailing to prostrate or climbing stems; branches quadrangular, hirsute to scabrid, scabrid on the angles; older branches with whitish peeling bark, ± glabrous. Leaves opposite, 5–10 × 0.3–0.5 cm, linear, sessile, apex acute to acuminate, margins entire, thickened, hirsute to scabrid; stipules deciduous. Flowers in axillary and terminal, few-flowered cymes. Pedicel 2–3 mm, elongating in fruit. Calyx obscurely 5-lobed, ± glabrous. Corolla greenish-yellow, 2–6 mm, campanulate, 5-lobed,

lobes lanceolate, acute. Stamens 5, inserted on the throat of the corolla tube; anthers exserted. Style branched; stigma globose. Berry globose, 1 carpel developing, black when ripe, juicy, ± glabrous.

Flowering and fruiting: May/June

Distribution and habitat: Northern Oman, in the Hajar mountains, growing in and under shrubs and amongst rocks and large stones. *Altitude*: 1800–2500 m. Distributed in Iran, Afghanistan and Pakistan. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 794.

Notes: Widespread in Baluchistan (SW Pakistan) from where it was originally described, reaching to the western and eastern and Hajar mountains in Oman. Not recorded on the Musandam Peninsula, probably due to its more exposed slopes and summit; uncommon and seen at a single locality on the Hajar mountains.

6. **Galium** L.

About 500 species, distributed throughout the world but chiefly in temperate regions.

1. Stems erect, glabrous or puberulous ..... 1. **G. decaisnei**
   Stems climbing or scrambling, with reflexed hairs or prickles 2
2. Fruit densely minutely tuberculate ..... 2. **G. ceratopodum**
   Fruit densely covered with hooked hairs or setae ..... 3. **G. aparine**

1. ***Galium decaisnei*** Boiss., Diagn. ser. 1, 6: 69 (1846).

Type: Iran: "hab. in Persia australis prope Gere", *Kotschy* 66; in regno Mascatensi, *Aucher-Eloy* 4660; in monte Sinai, *Bové* (syntypes G, P, K).

Synonym: *Galium setaceum* Lamk. subsp. *decaisnei* (Boiss.) Ehrend. (1958).

Description: Annual herb up to 15 cm. Stems ± erect, slender, branched, glabrous or puberulous. Leaves in whorls of 4–6, 8–15 × 1–3 mm, linear to narrowly oblanceolate, sessile, apex acute, margins entire, scabrid with ascending hairs on margins. Flowers minute in axillary and terminal lax cymes; Peduncle dichotomously branched; bracts filiform. Pedicel 3–5 mm. Calyx globose, limb lacking. Corolla white or greenish, ± 0.5 mm. Fruit with 2 mericarps, 0.5–1 mm, subglobose, densely covered with short ± hooked hairs.

Flowering and fruiting: February to April/May.

Distribution and habitat: Northern Oman, on the mountains and in open gravely places. *Altitude*: 300–1200 m. Distributed in SE Mediterranean, through SW Asia to C Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE; also found on Soqotra.

Distribution map & Illustration: 795.

2. ***Galium ceratopodum*** Boiss., Diagn. Pl. Orient. ser. 1, 3: 45 (1843).

Vernacular name: mulizqa.

Description: Annual herb up to 10 cm. Stems simple or branched, quadrangular, with stiff retrorse prickles along the angles. Leaves 5–17 × 3–5 mm, linear to oblanceolate, base cuneate, apex acute, margins entire with prickles along the edges and midrib. Flowers minute, in axillary cymes. Pedicel ± 0.5 mm, elongating in fruit. Calyx oblong. Corolla white, 4-lobed, ± 1 mm. Mericarps 1–2 mm, globose, tuberculate, reflexed when mature.

Flowering and fruiting: March to April.

Distribution and habitat: Northern Oman, and Musandam, on mountains, foothills and wadis, on silty soils amongst stones and near water channels and runnels. *Altitude*: 350–2000 m. Distributed from Egypt through the Arabian Peninsula, Iraq, Iran, and Afghanistan to C Asia. Elsewhere in the Arabian Peninsula found in UAE.

Distribution map & Illustration: 796.

3. ***Galium aparine*** L., Sp. Pl.: 157 (1753).

Description: Annual herb, up to 40 cm. Stems weak, ± erect, 4-angled, branched, with retrorse prickles along the angles. Leaves in whorls of 6–8, 10–25 × 3–7 mm, oblanceolate, base cuneate, apex mucronate, margins and surfaces with retrorse prickles. Flowers minute, in axillary and terminal lax cymes. Pedicel sometimes reflexed below the fruit. Calyx globose. Corolla white or greenish, ± 0.5 mm. Fruit with 2 mericarps, 0.5–1 mm, subglobose densely covered with hooked hairs.

Flowering and fruiting: February to April/May.

Distribution and habitat: Northern Oman, Musandam, on the mountains, near cultivated and irrigated field and plantations. *Altitude*: ± 1500 m. Distributed in Europe, N, W & E Asia, N America; introduced in many parts of the world. Elsewhere in the Arabian Peninsula found in ?Yemen, UAE.

Distribution map & Illustration: 797.

7. **Valantia** L.

Canary Is., Mediterranean region to Iraq and Arabia, Somalia and Socotra.

Valantia hispida L., Syst. Nat. ed. 10: 1307 (1759).

Description: Annual herb, up to 20 cm. Stems ± erect, simple or branched, glabrous to hispid. Leaves and leaf-like stipules in whorls of 4, 2–5 × 1–3 mm, oblanceolate to obovate, sessile, apex acute, margins entire, glabrous or pubescent, 1-veined. Flowers minute, in 3-flowered axillary cymes, the central flower bisexual, 4-merous, the laterals male, 3-merous. Peduncle and pedicel joining together, flattened, enlarged in fruit, bristly with hooked hairs, reflexed between leaves. Calyx obsolete. Corolla white or yellowish, ± 0.5 mm, cup-shaped. Stamens 3–4, exserted. Stigmas 2. Fruit with 2 mericarps, ± 2 mm, enclosed in the enlarged peduncle and pedicel, covered with stiff hairs.

Flowering and fruiting: February to April/May.

Distribution and habitat: Northern Oman in Musandam, recorded from the Rus al Jibal range, near cultivated and irrigated field and plantations. *Altitude*: ± 1500 m. Distributed from Ethiopia, Somalia through Arabia to Iraq and Iran; also in Turkey, the Mediterranean region and the Canary Islands. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 798.

Notes: Not common found, but perhaps under-collected.

8. **Plocama** Aiton

Gaillonia A.Rich. ex DC. (1830); *Neogaillonia* Lincz. (1973) nom. superfl.; *Jaubertia* Guill. (1841); *Crocyllis* E.Mey ex Hook. (1873); *Pterogaillonia* Lincz. (1973); *Pseudogaillonia* Lincz. (1973).

Thirty-four species, the majority in south-west Asia, a few in Africa, one on Canary Islands and one Mediterranean.

According to recent molecular studies (Backlund et al. 2007, cited above) the tribe Paederieae is subdivided into an Asian and an African clade. The genera *Putoria*, *Gaillonia*, *Plocama*, and *Aitchinsonia* form a clade that is sister to Theligoneae/ *Kellogia*/ Rubieae, and belong to the tribe Putorieae. *Plocama* is expanded to include (in Oman) *Jaubertia*, *Gaillonia*, *Pseudogaillonia* and *Pterogaillonia*.

1. Calyx limb not enlarging in fruit 2
   Calyx limb enlarging in fruit 3
2. Calyx with dense, stiff white hairs; corolla puberulous outside ..... 1. **P. aucheri**
   Calyx with few to numerous hairs, but not long and stiff as above; corolla glabrous or with a few short hairs on the outside ..... 2. **P. yemenensis**
3. Calyx limb salverform, enlarging in fruit to form a circular 5-lobed membranous wing ..... 4. **P. hymenostephana**
   Calyx limb bifid, enlarging in fruit to form 2 erect wings ..... 3. **P. calyoptera**

1. ***Plocama aucheri*** (Guill.) M.Backlund & Thulin, Taxon 56(2): 323 (2007).

Basionym: *Jaubertia aucheri* Guill. (1841). Type: Oman, Mascat & Iran, province Laristan, *Aucher-Eloy* 4680 (syntypes P, W). *Synonyms*: *Gaillonia aucheri* (Guill.) Jaub. & Spach (1843); *Neogaillonia aucheri* (Guill.) Puff (1982).

Description: Shrub to 1 m. Stems branched, divaricate, glabrous, lateral branches ending in sharp points, white. Leaves opposite (sometimes up to 3), on short shoots, fleshy, 2–7 × 0.5–1.5 mm, oblong to linear to spatulate, base tapering, apex acute, margins entire, glabrous; stipules forming a sheath. Flowers in terminal and lateral cymes. Pedicel ± 0.5 mm; bracts forming a denticulate sheath. Calyx 5-lobed; tube 2–4 mm, ovoid; lobes 0.5–1.5 mm, lanceolate, acute, densely plumose setaceous. Corolla funnel-shaped, white, 5-lobed, puberulous outside; tube 2–2.5 mm; lobes 2–2.5 mm. Stamens 5, ± exserted. Style bifid; stigma simple. Mericarps 2–3 mm.

Flowering and fruiting: January to May.

Distribution and habitat: Northern Oman including Musandam, on the foothills and lower slopes of the mountains, wadi beds and associated gravel plains; common. *Altitude*: 40– 450 m. Distributed in Iran, Afghanistan and Pakistan. Elsewhere in Arabian Peninsula found in UAE.

Distribution map & Illustration: 799.

2. ***Plocama yemenensis*** (Thulin) M.Backlund & Thulin, Taxon 56(2): 325 (2007).
Basionym: *Gaillonia yemenensis* Thulin (1998). Type: Yemen, Hodeida Region, Jebel Ras, *M. Thulin, Ghebrehiwet & A. Gifri* 9365 (holotype UPS; isotypes E, K).

Description: Shrub to 60 cm; stems branched, upper parts ± glabrous or papilla-like retrorse hairy, lower glabrescent, white, becoming grey with age. Leaves in pseudowhorls of up to 6 on contracted short shoots, fleshy, 3–10 × 0.5 -2 mm, linear to narrowly oblanceolate, tapering at base, apex obtuse, margins entire, glabrous to densely pubescent; stipules forming a sheath. Flowers solitary, on lateral and main stems. Pedicel ± 0.5 mm, often reflexed in fruit; bracts leaf-like. Calyx 5-lobed, ciliolate on the margins and with few to numerous hairs on the outer surface; tube ± 1 mm, ovoid, enlarging to 2 mm in fruit and covered with long uncinate hairs; lobes ± 1 mm, lanceolate, acute. Corolla funnel-shaped, white, 5-lobed, glabrous or sparsely puberulous near the top; tube ± 1 mm; lobes ± 2 mm. Stamens 5, ± exserted. Style bifid, stigma simple. Mericarps ± 2 mm.

Flowering and fruiting: September.

Distribution and habitat: Southern Oman, Dhofar, on the escarpment mountains, in wadis. *Altitude*: ± 600 m. Distributed in Yemen. A regional endemic not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 800.

Notes: This species is very similar to *Plocama aucheri* in facies but differing mainly in the pubescence of the calyx and morphology of pollen (Leonard, Bull. Jard. Bot. Nat. Belg. 54: 493 (1984)).

3. ***Plocama calycoptera*** (Decne.) M.Backlund & Thulin, Taxon 56(2): 323 (2007).
Basionym: *Spermacoce calycoptera* Decne. (1834) as "calyptera". *Synonyms*: *Gaillonia calycoptera* (Decne.) Jaub. & Spach (1843); *Pterogaillonia calycoptera* (Decne.) Lincz. (1973); *Jaubertia calyoptera* (Decne.) Tackh. & Boulos (1974); *Neogaillonia calycoptera* (Decne.) Puff (1982).

Description: Shrub, 20–60 cm. Stems erect, herbaceous, woody below, di- to trichotomously branched, puberulous, lower branches ± glabrous, white. Leaves opposite, somewhat fleshy, 10–25 × 1–3 mm, linear to narrowly oblanceolate, sessile, apex acute, margins entire, glabrous to pubescent, black when dry; stipules of 2 types: lower leaves without stipules or stipules small, ± ciliate, upper leaves with membranous 6–8-toothed sheath, white, glabrous, reticulately veined. Flowers solitary in branched spikes. Pedicel ± 0.5 mm.

Calyx 4-lobed, accrescent; lobes lanceolate, acute. Corolla 4–6 mm, funnel-shaped, white, 4-lobed, puberulous outside; lobes linear, obtuse, shorter than the tube, apex cucullate. Stamens 4, inserted in the throat of the corolla tube, 2 long and 2 short; anthers exserted. Style filiform, included; stigma simple, filiform. Fruit ± 10 mm (including wing), puberulous, carrying the enlarged membranous calyx limb.

Flowering and fruiting: October to April.

Distribution and habitat: Northern Oman, including Musandam, on the mountains, wadis and rocky slopes. *Altitude*: 850–1900m. Distributed in Egypt, Sudan, Palestine, Israel, Jordan, through to Iran and Pakistan. Elsewhere in Arabian Peninsula found in Bahrain, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 801.

4. ***Plocama hymenostephana*** (Jaub. & Spach) M.Backlund & Thulin, Taxon 56(2): 324 (2007).
Basionym: *Gaillonia hymenostephana* Jaub. & Spach (1843). *Synonyms*: *Pseudogaillonia hymenostephana* (Jaub. & Spach) Lincz.; *Neogaillonia hymenostephana* (Jaub. & Spach) Puff (1982).

Description: Perennial herb up to 20 cm, with a woody base. Stems prostrate to ascending, white pubescent. Leaves opposite, 3–15 × 2–3 mm, linear to linear lanceolate, sessile, apex acute, margins entire, white scabrid; stipules membranous, 1–2 dentate. Flowers in 1 2-flowered cymes, terminal and axillary. Calyx pink-yellow, tubular, limb lobed above; tube ± 2 mm, ovoid, pubescent; limb ± 2 mm, enlarging to 12 mm in fruit, orbicular, membranous, reticulately veined, unequally 5–7-lobed; lobes rounded, acute to apiculate. Corolla white, ± 2 mm, funnel-shaped, shallowly 5-lobed above, pubescent. Anthers inserted near the corolla throat, sessile, included. Style simple, deciduous; stigma bilobed. Fruit of 2 cocci, indehiscent, globose, hispid, crowned by the enlarged calyx limb.

Flowering and fruiting: February to April.

Distribution and habitat: Northern and southern Oman, in the foothills of the Hajar and Dhofar mountains, in crevices of rocks, silty depressions and amongst stones. Distributed in Iran, Afghanistan, Pakistan and India. Elsewhere in Arabian Peninsula found in UAE.

Distribution map & Illustration: 802.

9. **Pavetta** L.
About 400 species, distributed from SW Arabia, tropical Africa to South Africa; India and S China, through tropical Asia to Vanuatu, New Caledonia and Australia.

Pavetta longiflora Vahl, Symb. Bot. 4: 12 (1794).
Type: Yemen, Taiz, *Forsskål* 1559 (holotype C).
Synonyms: *Pavetta arabica* Bremek. (1934); *P. deflersii* Bremek. (1934).
Vernacular names: Jibbali: asebis; Dhofari Arabic: asiyes.

Description: Large shrub up to 2(–5) m with a greyish bark. Leaves opposite, 6–7 × 2–5 cm, narrowly obovate to oblong-ovate, base attenuate, apex acute, margins entire, often inrolled, pubescent beneath, glabrous and shiny above; petiole 2–2.5 mm; stipules brown, broadly ovate, acuminate. Flowers in terminal corymbose cymes, fragrant; pedicels lengthening to 12 mm in fruit. Calyx 4-lobed, ± 1.5 mm; lobes triangular, shortly pubescent. Corolla white, tubular, 4-lobed above; tube 12–20 mm, pubescent; lobes 6–8 mm, oblong, rounded, spreading. Stamens 4, inserted near the mouth of the corolla tube; anthers exserted. Style simple, exserted; stigma shortly bilobed. Fruit a fleshy berry, 6–10 mm, subglobose, with remnants of calyx at the apex, 2-seeded.

Flowering and fruiting: February to April.

Distribution and habitat: Southern Oman, Dhofar, at the bottom of watercourses or clinging to the steep slopes of ravines and gullies; not common. *Altitudes*: 300–1200 m. Endemic to Arabia; elsewhere found in Saudi Arabia, Yemen.

Distribution map & Illustration: 803.

Notes: In traditional medicine the leaves were crushed and rubbed over hands and body as a cleanser.

NEW RECORDS FOR OMAN

Coptosperma graveolens (S.Moore) Degreef subsp. ***arabicum*** (Cuf.) Degreef, Syst. & Geogr. Pl. 71(2): 375 (2002).
Synonym: *Tarenna graveolens* (S.Moore) Bremek. subsp. *arabica* (Cuf.) Bridson (1979).
This shrub has recently been recorded from Southern Oman, from the limestone plateau of Jebal Semhan and from Jebal Qamar above Dalkut and Sarfayt. (Patzelt et al., Edinb. J. Bot. 71: 172, 2014). It is distinguished by its small yellowish white tubular flowers and small black rounded fruits crowned by the persistent calyx. Elsewhere in the Arabian Peninsula known from Yemen.

Pyrostria phyllanthoides (Baill.) Bridson has been recorded from Southern Oman from Jebal Qamar, from the fog-affected dense *Anogeissus dhofarica* woodland (Patzelt et al., Edinb. J. Bot. 71: 172, 2014). Elsewhere in the Arabian Peninsula known from Yemen.

89. Caprifoliaceae

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Under the APG III (2009) system, Caprifoliaceae is circumscribed to include families Diervillaceae, Dipsacaceae, Linnaeaceae, Morinaceae and Valerianaceae. *Sambucus* and *Viburnum* formerly included in the Caprifoliaceae are now placed in Adoxaceae.

Lonicera L.
About 200 species distributed from Eurasia south to N Africa, India, Malesia to Philippines and Borneo; also North America south to Costa Rica.

Lonicera hypoleuca Decne. in Jacq., Voy. Inde 4: 81, t. 89 (1843).
Synonyms: *Lonicera aucheri* Jaub. & Spach, Ill. Pl. Orient. 1: 137. t. 73 (1845). Type: Monte Akadar, regni Mascate Arabiae, *Aucher-Eloy* 4640 (syntypes P; isosyntyes K, W); *Lonicera aurea* Auch. ex Hook.f. & Thomson (1858). Type as for *L. aucheri*.
Vernacular name: kumun.

Description: Deciduous shrub up to 2 m, branching from the base, spreading. Stems somewhat angular, pubescent with glandular and eglandular hairs, or glabrous to sparsely pubescent, getting glabrous when mature, reddish brown. Leaves simple, opposite, 10–22 × 7–16 mm, broadly ovate to obovate or broadly oblong, base rounded, apex obtuse, margins entire, mealyand lighter green on the undersurface; petiole 1–3 mm, pubescent with glandular and eglandular hairs. Flowers orange-yellow, in pairs, terminal fragrant; bracts oblong-lanceolate, longer than calyx lobes, connate, pubescent and glandular. Bracteoles connate, forming a cup at the base of flowers. Calyx tubular, 5-lobed above; lobes ±1 mm, pubescent and glandular, persistent. Corolla 2-lipped, tube 8–10 mm, gibbous at the base, glandular-pubescent; lobes 7–8 mm, oblong. Berries more or less connate at the base, cupped by the bracteoles; berry globose, 3–4 mm in diameter, red when ripe.

Flowering and fruiting: April to July.

Distribution and habitat: Northern Oman, on the western Hajar mountains in the Jebal al Akhdar range, on summit and plateau, in exposed areas, amongst junipers, and on the Eastern Hajar mountains scattered amongst *Prunus arabica* and *Ceratonia oreothauma*; common. *Altitude*: 2000–3000 m. Distributed in Iran, Afghanistan, Pakistan to the western Himalayas. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 804.

Notes: An Irano-Turanian species with its southernmost distribution in northern Oman. Plants in exposed locations tend to be more pubescent. The difference between *L. aucheri* and *L. hypoleuca* noted by Wendelbo in Flora Iranica (1965: p. 10), is that the stems are glabrous in *aucheri*. This character does not hold true for Oman material. I have seen the type of *L. aucheri*, it does not have glabrous stems but has a few hairs on the nodes; in all other characters it is similar to *hypoleuca*. The older stems tend to be glabrous and I have seen material from Iran and Baluchistan identified as *hypoleuca* where the older stems are glabrous.

NEW RECORDS FOR OMAN

Valerianella discoidea (L.) Loisel. has recently been recorded from Northern Oman, Jebal Nakl, from moist places on the north facing cliffs and rocky slopes (Patzelt et al., Edinb. J. Bot. 71: 170, 2014). Elsewhere in the Arabian Peninsula known from Saudi Arabia.

Valerianella szovitsiana Fisch. & C.A.Mey. has recently been recorded from Musandam, Jebal Harim, Sahil Al Sahosa, on rocky limestone plateau with *Cymbopogon jwarancusa*. (Patzelt et al., Edinb. J. Bot. 71: 170, 2014). Elsewhere in the Arabian Peninsula known from Saudi Arabia.

90. **Dipsacaceae**

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Under the Cronquist system Dipsacaceae (with Adoxaceae, Caprifoliaceae, Dipsacaceae and Valerianaceae) is included in the Order Dipsacales. Under APG III (2009) the families included are circumscribed differently though the circumscription of the Order remains the same. Caprifoliaceae is expanded to include families Diervillaceae, Dipsacaceae, Linnaeaceae, Morinaceae and Valerianaceae. Dipsacaceae therefore is no longer recognized as a separate family.

Scabiosa L.

A genus of about 100 species distributed in temperate Europe, the Mediterranean region, Asia and E Africa.

Scabiosa olivieri Coult., Mem. Dips.: 36. t. 2. (1823).

Description: Annual herb, 3–25 cm. Stems slender, often short, dichotomously branched, often reddish, hairy to sparsely pubescent. Leaves opposite, 1.8–7 × 0.4–1.4 cm, oblong-lanceolate to spatulate, some pinnatifid or pinnatipartite, apex acute, margins entire, sparsely pubescent. Flowers in involucrate heads, 9–12(–15) mm across. Involucral bracts 4–6 mm, broadly ovate-acuminate to ovate-lanceolate, pubescent, ciliate, about as long, as or longer than the flowers. Individual flowers surrounded by a tubular involucel. Involucel with 8 pits above, base silky hairy; pits conical to obovate, 1–1.2 mm long, ribs between pits not sulcate, expanded above into a scarious corona. Calyx limb of 5 setae, aristate, substipitate, setae ± 1 cm long, light brown, exceeding the flowers. Corolla tubular, 5-lobed, lobes equal in size, hispid on the outside. Corona 1.5–3 mm long, with 19–22 pubescent nerves. Stamens 4, exserted. Ovary inferior. Achene adnate to the involucel crowned with the persistent corona.

Flowering and fruiting: April to June.

Distribution and habitat: Northern Oman including the Musandam mountains and on western and eastern Hajar mountains, on open rocky hillsides and in sandy and silty depressions, amongst stones. *Altitude*: 1000–2500 m. Distributed from the Caucasus, C Asia,

east Mediterranean region, Turkey, Iran, Afghanistan to Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE.

Distribution map & Illustration: 805.

98. **Asteraceae (Compositae)**

by Norbert Kilian & Shahina A. Ghazanfar

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Introduction and glossary

The sunflower family (Asteraceae or Compositae) is represented in Oman with 102 species in 56 genera. Only 10 genera have at least three species in Oman. For three of them the southern Arabian Peninsula is part of their centre of diversity and they are represented with more than three species in Oman: these are *Iphiona* with four, and *Launaea* and *Pulicaria* with 11 species each.

In Oman the species of the sunflower family range in their *habit* from tiny ephemerals to shrubs of up to 5 m height and they are represented in almost all available habitats, except for strongly saline sites.

The *leaves* are usually (and unless otherwise stated in the descriptions) alternate, more rarely they are opposite. They are entire with entire or variously dentate margins, or 1–2× pinnately divided and then either pinnatifid (lobed less than halfways to the midrib), pinnatipartite (lobed about halfways to the midrib) or pinnatisect (lobed to or almost to the midrib).

The small *flowers* are arranged in head-like inflorescences, the flower heads or *capitula*. The capitula (singular: capitulum) are *radiate* if the marginal flowers have a ray lamina (as in the sunflower); they are *discoid* if all flowers are tubular, then mostly all being perfect (that is fully functional with style and stamina); they are *disciform* if the marginal flowers are filiform and pistillate or sterile and the flowers in the centre are tubular; they are *ligulate* if all flowers are uniformly 5-toothed ligulate, these plants always have white latex.

The stalk of the capitulum is a *peduncle*, and the capitula are either solitary or arranged in *synflorescences* of various shapes (often umbelliform, corymbiform, racemiform or paniculiform).

The flowers in the capitulum are embraced by a basket-like structure; they are surrounded by one or more series of small, modified, usually bract-like leaves, the *involucre*, its individual elements being the *phyllaries*. The involucre reaches its full length at flowering or becomes still longer towards fruiting; the length measurements, unless otherwise stated, refer to the fully developed involucre at flowering. The phyllaries and the flowers are inserted onto the concave, flat, convex or conical *receptacle*. The receptacle is *naked*, if not otherwise stated. Sometimes the flowers on the receptacle are subtended by bracts, the *paleae*, which are similar to the phyllaries or may be setaceous. In other cases the receptacle between the flowers is covered by long bristles which may equal the flowers in length.

The fruit, the *achene*, is usually crowned by a hairy or scaly structure, the *pappus*, which is, however sometimes absent, or very reduced. The achene apex below the pappus is sometimes apically contracted into a longer or shorter, thinner or thicker stalk, the *beak*. The pappus is, if not otherwise stated, *persistent*, or it falls off the mature fruit and is then *caducous*. In the case of a bristly pappus, the individual bristle is, if not otherwise stated, smooth or scabrid; it may, otherwise, be *plumose*, that is with side projections like a feather.

Key to the genera of Asteraceae in Oman

1. Plant with spiny or pungent leaves and or with spiny, pungent or awned phyllaries 2
   Plant without spiny or pungent leaves or phyllaries 12

2. Capitula single-flowered and aggregated into dense, globose composed flower heads ..... 6. **Echinops**
Capitula of many flowers, not aggregated into globose flower heads 3
3. Phyllaries with mucronate tip, not spiny or pungent; flowers yellow ..... 38. **Iphiona**
Phyllaries spiny or pungent; flowers purple, whitish, orange or yellow 4
4. Involucre with outer phyllaries or reduced spinose leaves embracing involucre longer than the phyllaries or the following phyllaries, respectively, either pinnately divided or with lanceolate, ± spinose-dentate, leaf-like appendage 5
Involucre without reduced spinose leaves embracing involucre and with outer phyllaries shorter than the following, entire 7
5. Outer phyllaries with a ± spinose-dentate to entire, spine-tipped herbaceous appendage; flowers orange-red ..... 4. **Carthamus**
Outer phyllaries or surrounding upper leaves pinnately divided, either pinnatifid and leaf-like, or pinnatisect-pectinate; flowers pink to purplish 6
6. Receptacle paleate; achenes villose ..... 2. **Atractylis**
Receptacle with white bristles; achenes glabrous ..... 8. **Notobasis**
7. At least some of the phyllaries appendaged by a terminal spine or awn longer than the phyllaries 8
Phyllaries pungent or with spines shorter than the phyllaries 9
8. Phyllaries appendaged by a purplish terminal awn as long as or longer than the phyllary ..... 10. **Zoegea**
Phyllaries appendaged by a terminal spine and 1–4 basal pairs of much smaller lateral spines ..... 5. **Centaurea**
9. Plant with spiny leaves decurrent along the stem ..... 3. **Carduus**
Plant without spiny leaves, leaves rarely decurrent 10
10. Involucre at flowering and fruiting ≤ 15 mm long 11
Involucre at flowering and fruiting ≥ 20 mm long ..... 7. **Jurinea**
11. Phyllaries pungent but not attenuate into a distinct spine; receptacle naked; pappus of 8–10 flat, white bristles to ± 7 mm ..... 1. **Dicoma**
Phyllaries appendaged by a brownish spine; receptacle with white bristles longer than the achenes; pappus of purplish or brownish scales ≤ 4 mm long ..... 9. **Volutaria**
12. Plant with succulent stems, leaves present only at the young shoots ..... 22. **Kleinia**
Plant without succulent stems 13
13. Tiny, mostly white to greyish tomentose, procumbent to mat-forming or erect, sometimes bottlebrush-like ephemerals with a few mm long capitula mostly clustered in often ± woolly glomerules 14
Plant different, if mat-forming and tomentose then capitula not clustered (see *Pulicaria pulvinata*) 18
14. Plant rather greenish than white-woolly, with a few tufted, erect, densely linear-leafy stems of bottlebrush-like appearance to 10 cm high; capitula crowded by 1–3 per node in long leafy racemes ..... 29. **Ifloga**

Plant white to greyish tomentose; stems not of bottlebrush-like appearance; capitula distinctly glomerate 15

15. Clustered capitula with conspicuously long-attenuate, protruding outer and middle phyllaries ..... 27. **Filago**
Clustered capitula without long-attenuate, protruding phyllaries 16

16. Phyllaries densely white-tomentose except for the very tips ..... 26. **Cymbolaena**
Phyllaries glabrous except for the outermost or the very base 17

17. Erect annual, stem simple, sparsely branched higher up; pappus bristles scabrid ..... 28/2. ***Helichrysum luteoalbum***
Procumbent annual, stem much-branched from the base, with filiform, a few cm long branches; pappus bristles plumose along their entire length ..... 30. **Lasiopogon**

18. Leaves opposite, at least in the lower portion of the stem 19
Leaves alternate, crowded or rosette 27

19. Leaves pinnately lobed 20
Leaves never pinnately lobed, margin entire or variously incised 22

20. Inner phyllaries connate for most of their length 21
All phyllaries free ..... 53. **Bidens**

21. Involucre with few outer phyllaries 1/3 as long as the inner; inner phyllaries each with 1–4 large ovate to elliptic, orange glands in the apical third; pappus < 4 mm long ..... 51. **Thymophylla**
Involucre of one row of inner phyllaries only; these with small elliptic to roundish glands dispersed on their outer surface; pappus > 10 mm long ..... 50. **Tagetes**

22. Pappus absent 23
Pappus present 26

23. Achenes hooked and spiny ..... 52. **Acanthospermum**
Achenes unarmed 24

24. Capitula 1–2-flowered, flowers yellow, forming dense axillary clusters, up to 2 cm across and surrounded by leaves ..... 49. **Flaveria**
Capitula with some to numerous, yellow or white flowers 25

25. Involucre of ± 5 leafy, 1–3 cm long, narrowly ovate phyllaries; capitula radiate, yellow-flowered, lamina of ray flowers ± 3–4 mm long; mature achene enclosed by a hardened palea ..... 57. **Sclerocarpus**
Involucre 4–6 mm long of ovate-lanceolate outer phyllaries and smaller inner phyllaries; capitula radiate, white-flowered, lamina of ray flowers 1–2 mm long; achenes not enclosed by paleae ..... 55. **Eclipta**

26. Pappus 1.5–3 mm long, of 5(–6) rigid, scarious scales abruptly tapering into a scabrous awn; capitula discoid, flowers purple, rarely white ..... 48. **Ageratum**
Pappus of a few < 1 mm long barbellate bristles from a small corona in the centre of the truncate achene apex; capitula very inconspicuously radiate; flowers white ..... 54. **Blainvillea**

27. Plant with white latex; capitula with all flowers 5-toothed ligulate 28

Plant without latex; capitula radiate (with marginal ray flower and central tubular flowers) or discoid (all flowers tubular) or disciform (marginal flowers filiform, ventral flowers tubular) 37

28. Involucre with phyllaries in one basally connate row; pappus (already discernible at flowering) of plumose bristles ..... 19. **Urospermum**

Involucre with phyllaries in several rows, the outer usually shorter than the innermost row; pappus of scabrous bristles or without bristles 29

29. Pappus (already discernible at flowering) absent or minute, less than 1 mm long .. 30

Pappus of scabrous bristles more than 1 mm long 32

30. Flowers yellow; achenes 8–15 mm long, narrowly cylindric and incurved, papillose or hooked 31

Flowers blue; achenes 2–3 mm long, stout ..... 11. **Cichorium**

31. Leaves almost linear, entire; achenes 8–15 mm long, at maturity stellately spreading, narrowly cylindric and falcately curved, with numerous hooked spines ..... 14. **Koelpinia**

Leaves obovate to spatulate, sinuate-dentate to pinnatifid; achenes 8–9 mm long, terete, incurved, papillose, the marginal partly enfolded by the inner phyllaries ..... 13. **Garhadiolus**

32. At least some of the achenes of a capitulum attenuate into a distinct capillaceous or thicker beak, sometimes short, sometimes even longer than the achene body 33

Achenes all beakless 35

33. Involucre and most of plant canescent-tomentose and pubescent of pale yellow, partly glandular hairs ..... 12. **Crepis**

Involucre and plant glabrous 34

34. Beak rather stout and short; achenes either sharply wrinkled and with pappus of both downy and stronger bristles, or achenes with whitish, rounded papillae and with pappus of uniform bristles ..... 16. **Launaea**

Beak rather filiform and long; achenes faintly wrinkled or smooth, never with whitish, rounded papillae; pappus always of uniform bristles ..... 15. **Lactuca**

35. Phyllaries green, at least outer and middle ones without scarious margins; involucre glabrous or glandular or basally white-tomentose ..... 18. **Sonchus**

Phyllaries with narrower or wider scarious margin; involucre glabrous 36

36. Achenes stout and coarsely tuberculate; pappus of uniform bristles, caduceus ..... 17. **Reichardia**

Achenes wrinkled or papillose, never coarsely tuberculate; pappus either of uniform bristles or of both downy and stronger bristles ..... 16. **Launaea**

37. Stem leaves all 1–2-pinnatipartite to -pinnatisect (incised more than halfways, or almost to the midrib) with narrow, linear to lanceolate segments 38

Stem leaves entire or, if pinnately divided, at most some leaves pinnatifid (incised less than halfways to the midrib) 44

38. Inner phyllaries connate to most of their length, each with 1–4 conspicuous, ovate to elliptic, orange glands in the upper third ..... 51. **Thymophylla**
Inner phyllaries free 39
39. Capitula radiate 40
Capitula discoid 43
40. Ray and disk flowers yellow; involucre 5–10 mm long 41
Ray flowers white, disk flowers yellow or white; involucre < 5 mm long 42
41. Involucre adpressed-hairy, 8–10 mm long; phyllaries in several, successively longer series; pappus of scales and bristles ..... 39/4. ***Iphiona senecioides***
Involucre ± glabrous, 5–8 mm long; outer phyllaries very short, inner phyllaries equal in length and in one row; pappus of bristles only ..... 23/2. ***Senecio glaucus*** subsp. ***coronopifolius***
42. Involucre 2–3 mm long; ray lamina up to ± 1 mm long; disk flowers white; capitula in lax panicles at the end of the branches ..... 56. **Parthenium**
Involucre 3–4 mm long; ray lamina up to ± 5 mm long; disk flowers yellow; capitula solitary at the end of the branches, on filiform, 3–10 cm long peduncles thickened upwards in fruit ..... 34. **Anthemis**
43. Delicate annual, less than 20 cm high; capitula terminal, solitary, on peduncles up to a few cm long ..... 36. **Matricaria**
Shrublet to 40 cm high; capitula densely sessile in paniculate synflorescences ..... 35. **Artemisia**
44. Pappus (discernible already at flowering) never with bristles; either of scales only or absent 45
Pappus (discernible already at flowering) at least in some achenes of a capitulum of bristles, sometimes in addition with scales 49
45. Pappus of (sometimes caducous) scales 46
Pappus absent in all flowers of a capitulum 47
46. Deciduous shrub or small tree to ± 5 m; capitula white-flowered, in secondary, many-capitulate glomerules 1.5–2 cm in diameter usually on several cm long peduncles ..... 47. **Blepharispermum**
Annual herb, acaulescent to shortly caulescent and few-branched, procumbent, only a few cm high; capitula radiate, yellow-flowered; involucre up to 15–20 mm in diameter ..... 40. **Pallenis**
47. Cushion forming subshrub, young branches adpressed-white-tomentose; leaves not more than 3 mm wide; achenes 2–3 mm long ..... 46. **Rhanterium**
Annual to pauciennial herbs; leaves much wider than 3 mm; young branches pubescent or glandular-hairy; achenes distinctly longer (up to 10–15 mm long) 48
48. Achenes homomorphic, with membranous, reddish wings to 4 mm wide ..... 25. **Tripteris**
Achenes strongly heteromorphic, unwinged, boat-shaped to annulate .. 24. **Calendula**

49. Pappus bristles entirely plumose; flowers all yellow, perfect and tubular-zygomorphic with 4 minute lobes and one much larger lobe ..... 41. **Pegolettia**
Pappus bristles scabrous, or, rarely, basally or apically somewhat plumose; flowers yellow or purplish-pinkish, not all of the same type or else not zygomorphic 50
50. Capitula either radiate (sometimes miniradiate; lense!) or discoid 51
Capitula disciform 60
51. Pappus composed of bristles and a much shorter series or a tiny corona of scales; capitula yellow- or purple-flowered 52
Pappus of bristles only; capitula yellowish-flowered (rarely pinkish) 54
52. Outer row of pappus a series of narrow, free scales 0.3–1.5 mm long 53
Outer row of pappus a corona of connate scales, 0.1–0.8 mm long ..... 45. **Pulicaria**
53. Capitula yellow-flowered, radiate; involucre 8–18 mm long ..... 39. **Iphiona**
Capitula purple-flowered, discoid; involucre 3–8 mm long ..... 20. **Vernonia**
54. Capitula radiate or miniradiate 55
Capitula discoid 59
55. Capitula miniradiate; the pistillate ray flowers exceeding in number the tubular perfect disk flowers 56
Capitula with a single outer row of conspicuous ray flowers; the tubular perfect disk flowers exceeding in number the ray flowers 57
56. Annual to pauciennial herbs; plant pubescent and glandular-hairy; capitula whitish- to pale yellow-flowered ..... 32. **Erigeron**
Shrub; plant glabrous but glandular, by touching becoming sticky vernicose and shiny; capitula bright yellow-flowered ..... 33. **Psiadia**
57. Involucre (and rest of the plant) ± glabrous (rarely faintly arachnoid-hairy) 58
Involucre (and rest of the plant) densely pilose ..... 42. **Pentanema**
58. Shrublet; involucre hemispherical; phyllaries in one row and connate to the middle .. .. 21. **Euryops**
Annual herbs; involucre cylindric; phyllaries all free to the base, outer phyllaries very short, inner phyllaries equal in length and in one row ..... 23. **Senecio**
59. Annual to perennial, basally woody and caespitose; leaves basally crowded, higher up more distantly situated and reduced; pappus of rather uniform, flattened, white bristles in one series ..... 1. **Dicoma**
Cushion forming shrublet; branches densely leafy up to the top, the linear-spatulate, entire to dentate, acute to pungent leaves not reduced higher up; pappus of brownish, rounded bristles in several series, inner successively longer than outer .... 39. **Iphiona**
60. Capitula, sessile, or if very shortly pedunculate then with whitish to pinkish involucre, and densely clustered in compact glomerate to hemispherical synflorescences; involucre 2–5 mm long, phyllaries to the most part scarious and straw-coloured, yellowish, white or pinkish; at least younger branches white-tomentose .... 28. **Helichrysum**

Capitula single or in laxer or denser but never very compact synflorescences, never with whitish to pinkish involucre; younger branches green to white-tomentose 61

61. Shrub or shrublet; pedunculate capitula or synflorescences on woody branches 62
Herb or, more rarely, subshrub; capitula or synflorescences on herbaceous branches 63

62. Young branches ± white-tomentose; capitula single on wiry peduncles several cm long; leaves usually with undulate and revolute margin, eglandular, on lower surface sparsely hairy to densely white-tomentose .... 31. **Phagnalon**
Young branches pilose; capitula in hemispherical to corymbiform synflorescences; leaves with flat margins, both surfaces glabrous or sparsely hairy to pilose .... 43. **Pluchea**

63. Involucre 7–9 mm long 64
Involucre 3–6 mm long 65

64. Leaves basally auriculate, in the lower portion of the stem somewhat interruptedly decurrent, in the upper stem portion more distantly situated and reduced .... 44. **Pseudoconyza**
Leaves neither auriculate nor decurrent, also in the upper stem portion densely situated and little reduced .... 43/1. ***Pluchea arabica***

65. Plant sparsely pubescent to glabrous; leaves linear-lanceolate with weakly auriculate base; capitula in corymbiform synflorescences; achenes with conspicuous red resin ducts .... 38. **Doellia**
Plant ± densely pilose and glandular; leaves obovate to spatulate with narrow base; capitula in paniculiform synflorescences; achenes without red resin ducts .... 37. **Blumea**

I. Tribe Dicomeae

1. **Dicoma** Cass.

About 25 species (according to the modern, narrower circumscription of the genus) of herbs or shrubs mainly distributed in tropical and southern Africa, three species present in the Arabian Peninsula, two species also extending to the Indian Subcontinent, one to Myanmar.

Dicoma schimperi (DC.) Baill. ex O.Hoffm. in Engler & Prantl, Nat. Pflanzenfam. 4(5): 339 (1893).

Basionym: *Hochstetteria schimperi* DC. (1838).

Vernacular name: shajarat al babaw.

Description: Annual to perennial and then also somewhat caespitose, erect herb, to 60 cm high, with little or strongly branched stems. Leaves up to 4–5 × 1–1.5 cm, elliptic-lanceolate, narrowed into a petiole-like base, distally denticulate and with a mucronulate tip, green, becoming smaller upwards the stem. Capitula discoid, single at the end of the twigs.

Involucre 9–12 mm long, with rigid, acuminate, pungent, linear-lanceolate phyllaries with a whitish midrib and a narrow green strip on either side. Flowers with yellowish to pinkish corolla with reflexed lobes, perfect, tubular. Achenes turbinate, up to 2.5 mm long, with antrorse hairs to 2 mm. Pappus uniseriate, of ± 8–10 rigid, flattened, barbellate bristles to 7 mm long.

Flowering and fruiting: February to May in Northern Oman; September to October in Southern Oman.

Distribution and habitat: Northern Oman and Southern Oman, Dhofar, in coastal and coast near mountain areas. Grows on open gravelly or rocky ground and in wadi beds. *Altitude*: 50–750 m. Distributed in the Horn of Africa region (Djibouti, Somalia) extending northwards to Sudan, Egypt, Sinai and Jordan; on the Asian mainland it is restricted to S Pakistan. Elsewhere in the Arabian Peninsula in western Saudi Arabia, S Yemen and eastern UAE.

Distribution map & Illustration: 806.

Notes: Two subspecies are known: subsp. *schimperi* is distributed across the entire range of the species, whereas subsp. *cinerea* (S. Ortiz & Rodr. Oubiña) S. Ortiz & Rodr. Oubiña in Ann. Missouri Bot. Gard. 85: 451 (1998) [Syn.: *D. cinerea* S. Ortiz & Rodr. Oubiña (1994)] has a disjunct distribution in central northern Somalia and southeastern Yemen (Hadhramout and extending into Al-Mahrah (Kilian 2010)). The latter subspecies is mainly characterised by a white-tomentose indumentum (instead of being glabrous) on stems, leaves and involucre, and ovate to suborbicular (instead of elliptic-lanceolate) leaves. Transitional forms between both subspecies with somewhat white-tomentose leaves and stems also occur in (western) Dhofar besides the typically glabrous plants.

Dicoma chatanensis N. Kilian (2010) has been described from the coastal mountains just across the border with Yemen. It is a shrublet with elliptic to ovate leaves, white-tomentose on the lower and greenish on the upper side, and a 6–8 mm long pappus of ± 60–80 flattened, barbellate bristles. The species grows on the foot or in the crevices of sea-facing rock faces. Its occurrence also in western Dhofar is likely.

II. Tribe Cardueae

2. **Atractylis** L.

About 30 species, distributed from the Canary Islands across the Mediterranean area to SW Asia and N Somalia.

Outer phyllaries distinctly different from the leaves, finely pectinate-pinnatisect, erect, ± 15 mm long, enclosing the capitula ..... 1. **A. cancellata**

Outer phyllaries very similar to the pinnatifid leaves, 25–30 mm long, spreading-erect, loosely embracing the capitula ..... 2. **A. kentrophylloides**

1. ***Atractylis cancellata*** L., Sp. Pl.: 830 (1753).
Vernacular name: jurrays, umm drus.

Description: Thistle-like, arachnoid-tomentose dwarf annual, usually branched from the base, 5–20 cm high. Leaves up to 2.5 × 0.5 cm, linear-spatulate, prickly toothed. Capitula discoid, single or by a few at the end of branches. Involucre of outer pectinate-pinnatisect, prickly-spinescent, erect phyllaries, ± 1.5 cm long, enclosing and only slightly exceeding the capitulum, and inner, densely imbricate phyllaries; inner phyllaries narrowly spathulate, entire phyllaries apically scarious and acute or awned, woolly and green along the midrib and with scarious margins. Receptacle paleate. Flowers with pink or purple corolla, tubular, perfect. Achenes obconical, ± 3 mm long, adpressed-villose of hairs much exceeding the achene apex. Pappus of plumose bristles, 6–7 mm long.

Flowering and fruiting: February to May.

Distribution and habitat: Northern Oman: Musandam (Ru'us al-Jibal), northern Hajar mountains, on shallow sands or silts between rocks, in hillsides, wadi beds and banks, ravines, fields, etc., rather rare. *Altitude*: up to 1600 m. Distributed from the Canary Islands across the Mediterranean area to the Arabian Peninsula, Turkey, Iraq and Iran. Elsewhere in the Arabian Peninsula distributed in Kuwait, Saudi Arabia.

Distribution map & Illustration: 807.

2. ***Atractylis kentrophylloides*** (Baker) F.G.Davies, Kew Bull. 36: 142 (1981).
Type: Dhofar mountains, 800 m (2600 ft), *J.T. Bent* 192 (holotype, K).
Basionym: *Carduncellus kentrophylloides* Baker (1895). *Synonym*: *Atractylis yemensis* Podlech (1982).

Description: Thistle-like, densely and shortly branched subshrub up to 30 cm high, branches white-tomentose. Leaves up to 5 × 2 cm, pinnatifid with spine-tipped lobes, thinly white-tomentose and greyish-green on the lower side. Capitula discoid, single at the end of the branches. Involucre of leaf-like, spreading-erect, 25–30 mm long outer phyllaries loosely embracing the capitulum, and densely imbricate inner phyllaries; inner phyllaries spatulate, entire, apically rounded to emarginate and spine-tipped, green to apically purplish and often cottony, otherwise glabrous. Receptacle paleate. Flowers with pale pink corolla, tubular, perfect. Achenes obconical, ± 4 mm long, adpressed-villose of hairs much exceeding the achene apex. Pappus of plumose bristles, ± 10 mm long.

Flowering and fruiting: September to March(?).

Distribution and habitat: Southern Oman, Dhofar, dry rocky plains and slopes, in particular on limestone, also in wadi beds. *Altitude*: 0–1400 m. Elsewhere in the Arabian Peninsula in Yemen, reaching up to 3000 m.

Distribution map & Illustration: 808.

Notes: The species in endemic to south western Arabian Peninsula extending eastwards as far as Dhofar.

Atractylis arabica Rech.f. has recently been recorded from the Eastern Hajar Mountains, Jebal Bani Jabir, Salma Plateau. (Patzelt et al., Edinb. J. Bot. 71: 168, 2014).

3. **Carduus** L.

About 90 species, distributed in Europe, the Mediterranean, N, SW and C Asia, and with a few species, in eastern tropical Africa; some species are weedy and widely introduced elsewhere.

Carduus pycnocephalus L., Sp. Pl., ed. 2: 1151 (1763).
Synonyms: *Carduus australis* L.f. (1782), *C. arabicus* Jacq. ex Murray (1784).
Vernacular name: shabah-al-jamal.

Description: Annual cobwebby to glabrescent herb up to 40(–80) cm high, usually branched from base, with one or more erect, spiny-winged stems, leafy up to the top. Leaves spathulate to lanceolate, up to ± 15 × 6 cm, pinnately lobed, with spinose margins; basal leaves rosulate, stem leaves long-decurrent, becoming smaller higher up. Capitula discoid, usually clustered by 2–5 at the end of the stems, subsessile. Involucre with imbricate, lanceolate-subulate, entire, green phyllaries with scarious margin, the innermost ones with purplish tips. Receptacle bristly. Flowers all tubular, pink to purple, strongly exceeding the involucre. Achenes 3–4 mm long, 1.5 mm in diameter, compressed, glabrous. Pappus a few times longer than the achenes, of numerous greyish-brown scabrid bristles connate at base and caducous as a whole.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam, Ru'us al-Jibal; occasional in wadis, plateaus and fields, and as a ruderal. *Altitude*: 250–1300 m. The species is centred in the Mediterranean and extending to western, central and northern Europe, and to SW and western C Asia; it has a strong weedy tendency. Elsewhere in the Arabian Peninsula distributed in Kuwait, Saudi Arabia, UAE.

Distribution map & Illustration: 809.

Notes: Several subspecies have been described but their taxonomy and nomenclature is problematic due to the weedy tendency of the species and various confusion in the literature. Therefore the rare Omani plants (occurrence data according to Jongbloed 2003 and Gary Feulner, pers. comm.) are not referred here to one of the subspecies recognised. The plants of the Musandam seem (all?) to have distally non-contracted phyllaries and the inner ones being purple-tipped, which may classify them as subsp. *arabicus* (Jacq. ex Murray) Nyman (1879), subsp. *cinereus* (M. Bieb.) Davis or subsp. *breviphyllarius* Davis (1975) in the sense of Flora of Turkey.

4. **Carthamus** L.

About 15 species distributed from the Mediterranean region and the Caucasus to C Asia, a few species distributed beyond as weeds, one species widely cultivated.

Carthamus tinctorius L., Sp. Pl.: 830 (1753).
Vernacular names: 'usfur, shawrana, zafaran.

Description: Annual herb to 1 m; stems erect, stout and rigid, branched, glabrous, pale yellow-green. Leaves ± 4–9 × 1–3 cm, ovate to lanceolate, glossy, base cuneate to clasping, apex obtuse, margins ± spinose-dentate with rather weak, a few mm long, yellowish spines. Capitula discoid, solitary at the end of the branches. Involucre ± 20–25 mm long; phyllaries yellowish-green, the outer with a leaf-like, lanceolate, ± spinose-dentate appendage, the inner with a narrowly triangular, spine-tipped appendage. Receptacle with white bristles overtopping the achenes. Flowers with orange to red corolla and yellow stamens and pistils, tubular, perfect. Achenes ± 6–8 × 3–4 mm, obliquely obovoid, weakly angular, smooth, pale, usually only the inner with a pappus. Pappus of ± 6 mm long bristles.

Flowering and fruiting: September to October in Southern Oman, February to April in Northern Oman.

Distribution and habitat: Northern and Southern Oman, cultivated in farms, village gardens and edges of date groves, also escaped and subspontaneous. *Altitude*: 20–500 m. Known only as a cultivated plant, cultivated in many parts of the world for the edible oil-producing fruits, and the red dye obtained from the flowers. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 810.

Notes: Safflower is widely cultivated in many parts of Arabia for the red-coloured dye obtained from the flowers used as a cosmetic, for dyeing cloth and wool, and as food colour; also the entire plant has been used in traditional medicine for treating red and swollen eyes.

Carthamus oxycanthus M.Bieb. is reported from the UAE adjacent to the Oman border at Hili, but is not recorded from Oman.

5. **Centaurea** L.

About 250 species, distributed in Europe, the Mediterranean area and Asia, with centres of diversity in the Mediterranean and the Irano-Turanian region.

1. Median leaves linear-lanceolate, almost entire, ± 10× longer than broad; involucre more than 20 mm long (terminal phyllary spines excluded) ..... 3. **C. wendelboi**
   Median leaves broad- to linear-lanceolate, lobed or denticulate, scarcely more than 5× longer than broad; involucre less than 18 mm long (terminal phyllary spines excluded) 2
2. Leaves broadly lanceolate in outline, 2–2.5 cm broad, margins flat, involucre 16–17 mm long ..... 1. **C. dhofarica**
   Leaves lanceolate to linear-lanceolate, ± 2 cm broad, margin undulate, involucre 13–15 mm long ..... 2. **C. pseudosinaica**

1. ***Centaurea dhofarica*** Baker, Bull. Misc. Inform. Kew 1895: 182 (1895).
Type: Oman, Dhofar, Hafa, *J.T. Bent* 35 (holotype, K).

Description: Perennial herb to subshrub, branches leafy, pubescent. Leaves broadly elliptic to spatulate, obtuse, more than 2 cm wide, the lowermost pinnatifid, the others sinuate-dentate, margins flat. Capitula disciform, single at the end of the branches. Involucre 16–17 mm long, campanulate; phyllaries straw-coloured, appendaged by a terminal spine and 1–2 basal pair of much smaller lateral spines. Receptacle bristly. Flowers with yellow corolla, much exceeding the involucre. Achenes shiny, straw-coloured. Pappus of brownish bristles as long as achenes.

Distribution and habitat: Southern Oman, Dhofar and adjacent Al Mahra, Yemen.

Distribution map & Illustration: 811.

Notes: We have considerable doubts that *Centaurea dhofarica* is specifically distinct from *C. pseudosinaica,* but further studies are needed to clarify this. For the time being we follow Wagenitz (1984) and treat the two taxa distinct.

2. ***Centaurea pseudosinaica*** Czerep., Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 20: 392 (1960).
Synonym: *Centaurea solstitialis* auct. non L.

Perennial; leaves of the branches sessile or very shortly decurrent; innermost row of pappus bristles as long as the outer ..... a. subsp. **niebuhrii**
Annual to pauciennial; leaves of the branches long-decurrent; innermost row of pappus bristles much shorter than the outer ..... b. subsp. **pseudosinaica**

a. subsp. ***pseudosinaica***
Vernacular names: amraar, hanga, murrar, kassoob, keskas.

Description: Annual to pauciennial herb, branched from base, up to ± 40 cm high, with short, stiff hairs. Leaves lanceolate or linear-lanceolate, pinnately divided with narrow segments, undulate, of the main axis petiolate, of the branches long-decurrent. Capitula disciform, single at the end of the branches. Involucre 13–15 mm long; middle phyllaries green and straw-coloured, appendaged by a terminal spine ± 15–20 mm long and 1–2 basal pair of much smaller lateral spines. Receptacle bristly. Flowers with bright yellow corolla, much exceeding the involucre. Achenes 3–4 mm long, brown, shiny. Pappus ± 3 mm, reddish-brownish, innermost row of bristles much shorter than the outer.

Flowering and fruiting: February to May.

Distribution and habitat: Northern Oman, lower Hajar mountains, foothills, wadi beds. *Altitude*: 50–500 m. Distributed in Iraq, the Arabian Peninsula and Iran. Elsewhere in the Arabian Peninsula present in Saudi Arabia, Yemen, Kuwait, Qatar, UAE.

Distribution map & Illustration: 812.

b. subsp. ***niebuhrii*** Wagenitz, Notes R.B.G. Edinb. 41: 459 (1984).

Description: Perennial herb up to ± 50 cm high, with short, stiff hairs. Leaves lanceolate or linear-lanceolate, pinnately divided with narrow segments, undulate, of the main axis petiolate, of the branches sessile or scarcely decurrent. Capitula disciform, single at the end of the branches. Involucre 13–15 mm long; middle phyllaries green and straw-coloured, appendaged by a terminal spine ± 15–20 mm long and 1–2 basal pair of much smaller lateral spines. Receptacle bristly. Flowers with bright yellow corolla, much exceeding the involucre. Achenes 3–4 mm long, brown, shiny. Pappus ± 3 mm long, reddish-brownish, innermost row of bristles as long as the outer.

Flowering and fruiting: at suitable sites all around the year.

Distribution and habitat: Southern Oman, Dhofar, on sparsely vegetated rocky slopes, wadi beds. *Altitude*: ± 100–900(?) m. Distributed in south-western Arabian Peninsula. Elsewhere known from Yemen.

Distribution map & Illustration. 813.

Notes: The subspecies is endemic to south-western Arabian Peninsula. See note under *Centaurea dhofarica*.

3. ***Centaurea wendelboi*** Wagenitz in Rech.f., Fl. Iran. 139b: 370 (1980).
Vernacular name: merare.

Description: Cushion forming subshrub to ± 50 cm high; leaves and stems weakly tomentose, glabrescent. Leaves lyrately divided (the lower) to linear-lanceolate and ± entire. Capitula disciform; single at the end of the branches. Involucre 25–27 mm long, middle phyllaries green and straw-coloured, appendaged by a terminal spine 15–25 mm long and 3–4 basal pair of much smaller lateral spines. Receptacle bristly. Flowers bright yellow, glandular-sticky, much exceeding the involucre. Achenes 5–6 mm long. Pappus 6–7 mm long, innermost row of bristles as long as the outer.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal) and Jebal Akhdar (Jebal Shams); rocky slopes and ridges. *Altitudes*: 1000–2950 m. Distributed in southern Iran (province Lar) across the Strait of Hormoz and in both Northern Oman and north-easternmost UAE but not elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 814.

6. **Echinops** L.

About 120 species of annual and perennial herbs, distributed in Eurasia, the Mediterranean region and Africa, a few species introduced and distributed beyond.

In the Arabian Peninsula 15–20 species may occur but a taxonomic revision is still missing, the present treatment therefore being preliminary. Two species have been reported

so far from Oman; special attention should be payed for the little known first one and for plants from Southern Oman.

Leaves pinnatisect; flower heads globose ± 2 cm in diameter at flowering; corolla white; anther tube yellow ..... 1. **E. atrox**
Leaves bipinnatisect; flowers heads globose ± 4 cm in diameter at flowering, to ± 6 cm at fruiting; corolla white to very pale blue, anther tube basally yellow and bluish-white towards apex ..... 2. **E. erinaceus**

1. ***Echinops atrox*** Kit Tan, Ann. Bot. Fenn. 32: 117 (1995).
Type: Oman, [Musandam], Ayn Sih, Wadi al Ayn, ± 456 m, 19.3.1982, *M.D. Gallagher* 639/13 (holotype, E).

Description: Perennial herb, with rigid, leafy, white-tomentose, glandular-hairy, erect-ascending, branched stem to 40 cm. Leaves to ± 18 cm (and more?) long, pinnatisect, coriaceous and with spines at most ± 15 mm long, upper surface greyish-green, sparsely glandular-hairy and with white-arachnoid veins, lower surface white-tomentose. Capitula single-flowered, many of them aggregated to globose, flower heads of at most ± 2 cm in diameter. Flowers all tubular and perfect, with white corolla and yellow anther tube.

Flowering and fruiting: March to April.

Distribution and habitat: Described from Northern Oman, Musandam, Ru'us al Jibal. The type locality 'Ayn as-Sih' is a unique site in the Musandam, where a permanent spring is located deep within the gorge of Wadi al-'Ayn, which flows north from Jebal Harim to Khasab and nourishes one of the greenest spots in the area and the only one sheltering a hygrophilous vegetation, including species such as *Arundo donax, Epipactis veratrifolia, Nerium oleander, Schoenus nigricans* and *Pteris vittata* (pers. comm. Gary Feulner). According to the determination by Kit Tan also two collections from Dhofar (see map) are referable to this little known species. *Altitude*: 450–500 m. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 815.

2. ***Echinops erinaceus*** Kit Tan, Ann. Bot. Fenn. 32: 124 (1995).
Type: Oman, West Hajar Mts, near Firaah, at top of Wadi Sahtan below Jebal Akhdar, stony limestone slopes, 1000 m, 26.3.1980, *J.R. Edmondson* 3496 (holotype, E; isotype, ON).
Synonyms: *Echinops* sp. Jongbloed, The comprehensive guide to the wild flowers of the United Arab Emirates: 143 (2003); *E. spinosissimus* sensu auct. Ghazanfar (1992: 44); Pickering & Pazelt, Field guide to the wild plants of Oman: 22 (2008).
Vernacular names: shawk al gamal, qan'a, kan'a, hinaq.

Description: Perennial herb with rigid, leafy, brownish purple, glandular-hairy, erect, branched stems to ± 2 m high. Leaves to more than 20 cm long, bipinnatisect, coriaceous and with spines 10–25 mm long, upper surface greyish-green, densely glan-

dular-hairy, lower surface white-tomentose. Capitula single-flowered, many of them aggregated to globose, composed flower heads of ± 4 cm in diameter at flowering, to ± 6 cm at fruiting, its spines not protruding the open flowers. Flowers all tubular and perfect, with white to very pale blue corolla and basally yellow, towards apex bluish-white anther tube.

Flowering and fruiting: Most of the year.

Distribution and habitat: Northern Oman, Ru' us al Jibal and Hajar mountains, Southern Oman, Dhofar(?); among rocks, wadi banks, mountain slopes; common. *Altitude*: 100 2000 m. Distributed in a scattered way in the southern Arabian Peninsula, elsewhere known from SW Saudi Arabia, easternmost UAE and Yemen.

Distribution map & Illustration: 816.

Notes: The species is endemic to the southern part of the Arabian Peninsula.

7. **Jurinea** Cass.

About 200 species of herbs and shrublets distributed from C Europe, the Mediterranean area and the Caucasus across W to C Asia.

Leaves entire, broadly elliptic to broadly spatulate, margins flat; phyllaries erect .... 1. **J. berardioides**

Leaves pinnatisect with remote, linear segments, or entire and linear-elliptic, with revolute margins; phyllaries (except innermost) recurved from the middle ... 2. **J. carduiformis**

1. ***Jurinea berardioides*** (Boiss.) O.Hoffm. in Engler & Prantl, Nat. Pflanzenfam. 4(5): 321 (1893).

Basionym: *Aegopordon berardioides* Boiss. (1846).

Vernacular names: al mabarqashah, hashushat.

Description: Stemless perennial rosette plant. Rosette leaves up to 8 × 4 cm, broadly elliptic to spatulate, entire; upper surface velutinous and greyish- to purplish-green. Capitula discoid, sessile, by 4–6 tightly clustered in the centre of the leaf rosette. Involucre broadly campanulate, ± 20–25 mm long; phyllaries in several series, imbricate, linear-lanceolate, entire, erect, green and often purple-margined, attenuate into an apical spine. Receptacle bristly. Flowers whitish, tubular. Achenes 4–5 mm long, obconical, 4-angular, verrucose. Pappus ± 10–15 mm long, whitish, caducous, of shortly plumose bristles.

Flowering and fruiting: February to May.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal); on open rocky ground and in fallow fields, also recorded from the Eastern Hajar mountains with *Prunus* and *Ceratonia oreothauma*. *Altitude*: above 800 m; Distributed in Iran, Afghanistan and Pakistan. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 817.

2. ***Jurinea carduiformis*** (Jaub. & Spach) Boiss., Diagn. Pl. Orient. ser. 1, 6: 111 (1846).
Basionym: *Outreya carduiformis* Jaub. & Spach (1842).

Description: Annual to perennial arachnoid-tomentose, cushion-forming herb with several very short, branched, leafy stems. Leaves with revolute margins and often undulate; rosulate basal leaves pinnatisect with remote, linear segments; stem leaves narrowly decurrent, linear-elliptic, mostly entire. Capitula discoid, single at the end of branches. Involucre ± 20–25 mm long; phyllaries in several series, imbricate, linear-lanceolate, entire, green, attenuate into an apical spine and, except for the innermost ones, recurved from the middle and pointing outwards. Receptacle bristly. Flowers pink, tubular, perfect. Achenes 5–6 mm long, obconical, 4-angular, verrucose. Pappus up to ± 30 mm long, dirty white, of many barbellate bristles.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal), in silt among rocks on exposed high elevation plateaus. *Altitude*: 1100–1700 m. Distributed in the mountains of Iran, Iraq, Afghanistan and Pakistan. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 818.

Notes: Apparently in the Arabian Peninsula only known from Musandam. Rare. One picture record by C. Lehmann given in Jongbloed (2003). Distribution records and above habitat data according to Gary Feulner (pers. comm. March 2009).

8. **Notobasis** (Cass.) Cass.
One species, distributed in the Mediterranean and extending eastwards to the Caucasus and Iran.

Notobasis syriaca (L.) Cass. in Cuvier, Dict. Sci. Nat. 35: 171 (1825)
Basionym: Carduus syriacus L. (1753)

Description: Erect annual thistly herb to 60 cm (or more) high, rather sparsely branched, sparsely arachnoid-hairy. Leaves spinose, pinnatifid with spine-terminated lobes; stem leaves auriculately clasping the stem; uppermost leaves reduced, with linear-lanceolate to subulate spiny lobes. Capitula discoid, single or by a few at the end of the branches, the lateral sessile or subsessile, subtended and surrounded by reduced spiny leaves. Involucre 15–20 mm long, 10–20 mm in diam., sparsely arachnoid-hairy; phyllaries in some series, imbricate, ± lanceolate, entire, spine-tipped. Receptacle bristly. Flowers purple, tubular, perfect. Achenes 5–6 mm long, broadly obovoid, slightly compress, glabrous, dark brown. Pappus 12–15 mm long, caducuous as a unit, of flat white, plumose bristles.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal). *Altitude*: 1100 m. Distributed in the Mediterranean and extending eastwards to the Azerbaijan, Iraq and Iran; frequently as a ruderal and weed. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 819.

Notes: The species is known from a single collection made by Gary Feulner (*GRF* 10) on 4 April 1997 in N Oman, Musandam (Ru'us al Jibal), upper Wadi Wahiya (enroute Dardoor); specimen preserved at the herbarium of the Sharjah Natural History Museum and Desert Park, UAE (pers. comm. G. Feulner).

9. **Volutaria** Cass., nom. cons. prop.
Fifteen species, distributed from the Canary Islands across N Africa to the Horn of Africa region and the Arabian Peninsula.

Stem and leaves glabrescent greyish-whitish of a floccose-tomentose indumentum; involucre 9–2 mm long; achenes with a distinctly lateral hilum ..... 1. **V. dhofarica**
Stem and leaves green, with bristles and a sparse indumentum of woolly hairs; involucre 13–15 mm long; achenes with an (almost) basal hilum ..... 2. **V. sinaica**

1. ***Volutaria dhofarica*** Wagenitz, Candollea 46: 409 (1991).
Type: Oman: Dhofar, 43 km N of Salalah on Thumrait road, 21.9.1977, *Radcliffe-Smith* 5139 (holotype, K).

Description: Erect annual to pauciennial herb to 25 cm high, branched from base, glabrescent greyish-whitish floccose-tomentose. Leaves lanceolate in outline, pinnately lobed with 3–4 segments and dentate, upwards the stem becoming smaller and entire. Capitula disciform, single at the end of the branches. Involucre 9–12 mm long, loosely floccose-tomentose; phyllaries imbricate, entire, green, 3-veined with straw-coloured margin and brownish, pungent tip. Receptacle with tufts of white, linear bristles longer than the achenes. Marginal flowers filiform, with longish lobes, whitish to purplish, sterile; disk flowers intensively rose, tubular, bisexual. Achenes ± 3 mm long, hairy, with distinctly lateral hilum. Pappus ± 2–3 mm long, of several rounded, denticulate, pale to brownish or purplish scales.

Flowering and fruiting: September to November (?).

Distribution and habitat: Southern Oman, Dhofar, on open subdesert slopes, wadi gravel, sparsely vegetated rocky sites. *Altitude*: 0–1500 m. Endemic to central southern Arabian Peninsula. Elsewhere in the Arabian Peninsula found in SE Yemen.

Distribution map & Illustration: 820.

2. ***Volutaria sinaica*** (DC.) Wagenitz, Candollea 46: 409 (1991).
Basionym: *Amberboa sinaica* DC. (1838). *Synonyms*: *Amberboa leucantha* Coss. ex Batt. (1903); *Volutaria leucantha* (Coss. ex Batt.) Maire (1934); *Volutaria lippii* auct., *Amberboa lippii* auct.
Vernacular names: lema, anbr.

Description: Annual herb, up to 40 cm high, with leafy, erect stems. Leaves up to 11 × 3 cm, spatulate to elliptic, deeply sinuate-dentate to pinnatifid, with bristly hairs, the lower leaves attenuate into a petiole up to 2–3 cm long. Capitula disciform, single at the end of

the branches. Involucre 13–15 mm long, somewhat hairy; phyllaries imbricate, entire, pale green, 3-veined, with pale to scarious margin, outer and middle ones with blackish, inner with pale, pungent tip. Receptacle with tufts of white, linear bristles equalling or slightly exceeding the achenes in length. Marginal flowers filiform with longish lobes, whitish to purplish, sterile; disk flowers purplish, tubular, bisexual; rarely all flowers white. Achenes 4–5 mm long, brown, with 1.2–1.5 mm long, stiff hairs; hilum basal or almost so. Pappus ± 4 mm long, of several acute, denticulate, purplish scales.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Hajar mountains, foothills and coastal plain, sandy soil, in wadis, fallow fields, roadsides. *Altitude*: 0–1000(?) m. Distributed from Morocco across N Africa and the Arabian Peninsula to Oman. Elsewhere in the Arabian Peninsula found in N and E Saudi Arabia, UAE.

Distribution map & Illustration: 821.

10. **Zoegea** L.

Three annual species distributed from the SE Mediterranean across SW to C Asia.

Zoegea purpurea Fresen., Mus. Senckenberg. 1: 86, t. 5 (1833).

Description: Delicate annual, up to ± 40 cm high, with 4-angled, sparingly branched, erect, leafy stems. Basal leaves 10–30 (or more) × 2–10(–15) mm, narrowly spatulate, acute, entire to pinnately divided with linear segments; stem leaves smaller, linear-lanceolate, entire. Capitula radiate, single at the end of long branches. Involucre 9–12 mm long (phyllary awns excluded); phyllaries in several rows, linear-lanceolate, ± glabrous; the outer pale, scarious, pectinate-fimbriate and terminated in a purplish awn as long as or longer than the phyllary; the inner entire, whitish scarious with greenish centre and with a short, concolorous or purplish awn or acuminate tip. Receptacle with many white bristles. Flowers with whitish corolla, marginal neuter, equalling involucre in length, disk flowers perfect, tubular. Achenes 2–3 mm long. Pappus of outer rows of short scales, a middle row of 4–5 mm long bristles and an inner row of ± 1 mm long bristle-like scales.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam and Hajar mountains; rocky slopes, wadi banks. *Altitude*: 500–1700 m. Distributed from Egypt, Jordan, Palestine, Israel and Syria through the Arabian Peninsula, Iraq, Iran, Afghanistan and Pakistan to C Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia, eastern UAE.

Distribution map & Illustration: 822.

III. **Tribe Cichorieae**

11. **Cichorium** L.

Six species, distribution centred in the Mediterranean region and SW Asia; two species, *C.*

endivia and *C. intybus*, are widely cultivated, the latter also found as a ruderal widespread in temperate and semiarid regions.

Cichorium intybus L., Sp. Pl.: 813 (1753).
Vernacular name: hindibaa bareeya.

Description: Perennial herb with white latex and erect, branched stem, to more than 1 m high. Basal leaves well over 10 cm long, obovate to spatulate, rounded to acute, entire to runcinate, stem leaves similar but increasingly smaller towards stem apex. Capitula ligulate, solitary or in clusters of a few, sessile or on several cm long, 2–3 mm thick peduncles. Involucre up to 5 mm wide and 16 mm long. Flowers bright blue. Achenes stout, 2–3 mm long. Pappus a ring of 0.2–0.5 mm long scales.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Hajar mountains from Musandam to the east, on open rocky or stony ground, in (fallow) fields, as a rare weed or ruderal. Distributed in Europe, N Africa, W and C Asia. Elsewhere in the Arabian Peninsula found in Saudi Arabia and UAE as a rare weed or ruderal.

Distribution map & Illustration: 823.

12. **Crepis** L.
About 180 species distributed throughout the northern hemisphere and Africa.

Crepis kotschyana (Boiss.) Boiss., Fl. Orient. 3: 852 (1875).
Basionym: Barkhausia kotschyana Boiss. (1846).

Description: Annual herb with white latex, 5–20 cm high, canescent-tomentose and pubescent of pale yellow, partly glandular hairs, divaricately branched from the base, branches leafy, spreading-erect. Leaves spatulate to lanceolate, entire to sinuate-dentate, rarely pinnately lobed. Capitula ligulate, single at the end of branches. Involucre 7–11(–13) mm long; inner phyllaries linear-lanceolate, strongly keeled towards fruiting, their inner surface with adpressed-pubescent apical portion. Flowers bright yellow. Achenes yellowish- to reddish-brown; inner ones 7–11 mm long, with a slender beak longer than the body; marginal achenes enclosed by inner phyllaries, shorter and without or with shorter beak. Pappus of numerous white bristles, 4–6 mm long, usually shorter in the marginal achenes.

Flowering and fruiting: March to May.

Distribution and habitat: Northern Oman, Musandam and western Hajar mountains, apparently very scattered and altogether rare, but locally common, on rocky slopes. *Altitude*: 100–1900 m. Distributed from NW Saudi Arabia and Syria across Iraq, Iran and Afghanistan to Turkmenistan and W Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia (N).

Distribution map & Illustration: 824.

Notes: Several collections have been made by Radcliffe-Smith, J.R. Edmondson, R. Whitcombe, R.A. Western and G.R. Feulner from Oman and UAE, but *Crepis kotschyana* has not been reported so far for either country. Western (1989; cited in bibliogr. Vol. 1) reported it as "*Crepis* sp." from "Oman/Musandam" and characterised it as "locally common". Ghazanfar (1992) listed it as *C. foetida* L. based on a misdetermined specimen. In fact, *C. kotschyana* is similar and related to *C. foetida,* which is not present in the area, without sharing its foetid odor when crushed (pers. comm. G. R. Feulner). *Crepis kotschyana* has a disjunct distribution in the Arabian Peninsula, occurring in N Saudi Arabia (probably extending from Iraq) and in NW Oman/UAE (probably extending from S Iran across the Straits of Hormuz).

13. **Garhadiolus** Jaub. & Spach

Four species, distributed from the E Mediterranean (Egypt, Jordan, Palestine, Syria and Turkey) to the Caucasus and across SW Asia to Turkmenistan and Pakistan.

Garhadiolus hedypnois Jaub. & Spach, Ill. Pl. Orient. 3: 120 (1850).

Synonyms: *Garhadiolus angulosus* Jaub. & Spach (1850); *Rhagadiolus angulosus* (Jaub. & Spach) Kupicha (1975).

Description: Small annual herb with white latex, pubescent of narrowly triangular hairs, stems dichotomously branched from near the base, less than 20 cm high. Leaves mostly basal, to 8 × 2.5 cm, obovate to spatulate, sinuate-dentate to pinnatifid. Capitula ligulate, with up to 10–12 flowers, in a cymose, rigid synflorescence. Involucre cylindric, with a few minute, deciduous outer phyllaries and linear, finally indurate, persistent inner phyllaries, at anthesis 3–4 mm, at fruiting 7–9 mm long. Flowers yellow. Achenes 8–9 mm long, terete, incurved, papillose, the marginal partly enfolded by the inner phyllaries. Pappus of some minute, 0.1–0.2 mm long hairs.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam, Ru'us al-Jibal, on sandy wadi banks, gravel terraces, stony slopes, cultivated fields, uncommon. *Altitude*: 1100–1500 m. Distributed from Egypt, Israel, Palestine, Lebanon, Syria, Jordan and Turkey northwards to the Caucasus and Turkmenistan and eastwards to Pakistan. Not found elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 825.

Notes: The species is rare in its limited area of occurrence in Oman. Only known from records by A. Radcliffe-Smith in 1976 (*Radcliffe-Smith* 4159, K, ON) and by Gary Feulner from the 1990s onwards (*Feulner* 464, B). Gary Feulner provided the habitat data.

14. **Koelpinia** Pall.

Five annual species, distributed from the Mediterranean region across SW to C Asia.

Koelpinia linearis Pall., Reise Russ. Reich. 3: 755 (1776).
Vernacular name: lahiat al tais.

Description: Annual herb with white latex, glabrous to pubescent, with several weak, slender stems, sparsely branched already from base, up to 30 cm tall. Leaves almost linear up to 10 × 0.2 cm. Capitula ligulate, with less than 10 yellow flowers, on slender peduncles, single or by a few at the end of the branches. Involucre at flowering 4–5 mm long, of 2–3 short outer and 5 -7 linear-lanceolate inner phyllaries. Flowers pale yellow, little exceeding the involucre. Achenes stellately spreading, 8–15 mm long, narrowly cylindric and falcately curved, with a longitudinal groove on the inner side and numerous hooked spines on the outer side, distally attenuate and with a few outwards curved spines on the tip. Pappus absent.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam, Ru'us al-Jibal, NE of As-Saye, Hajar mountains, Jebal Hafit area and Wadi Huwayah, on gravel, sand, silt among rocks; rare but possibly overlooked. *Altitude*: 500–1600(?) m. Distributed from Spain and Morocco across N Africa and from Sinai northeastwards to the Caucasus and C Asia and eastwards across the Arabian Peninsula to Iraq, Iran, Afghanistan, Pakistan and N India. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Saudi Arabia, UAE.

Distribution map & Illustration: 826.

Notes: Occurrence data from Jongbloed (2003) and for Musandam from Gary Feulner (pers. comm. March 2009).

15. **Lactuca** L.

Over 100 species if treated in its wider sense, or 50–70 in a narrower sense, and widely distributed in Eurasia, Africa and North America.

1. Subshrub with whitish stems; stem leaves long-decurrent as linear lines; achenes with concolorous stout beak ..... 3. **L. orientalis**
   Annual or perennial herbs with green stems; stem leaves not decurrent; achenes with discolorous (whitish) filiform beak 2
2. Annual herb; achene body greyish-blackish, less than 1 mm wide, with three ribs on either side, apically u-shaped-emarginate at the base of the beak ..... 1. **L. dissecta**
   Perennial herb; achene body reddish-brown, more than 1 mm wide, with 1 rib on either side, apically attenuate at the base of the beak ..... 2. **L. inermis**

1. ***Lactuca dissecta*** D.Don, Prodr. Fl. Nepal.: 164 (1825).

Description: Annual herb with white latex, basally rosulate leaves and one or several green, leafy stems, up to 50 cm high. Leaves obovate to spatulate or elliptic in outline, sinuate-dentate or pinnatifid to pinnatisect, 4–20 × 0.5–3.5 cm, decreasing in size and incision towards stem apex. Capitula with up to 20 flowers, ligulate, in a divaricately branched,

corymbose synflorescence. Involucre narrowly cylindric, at anthesis ± 6 mm, at fruiting up to 14 mm long. Flowers usually pale yellow, sometimes (if in Oman?) lilac or bluish. Achenes (including beak) 6–7 mm long, body blackish, compressed, 3-ribbed on either side and wrinkled, up to 2.5 mm long, the pure white, filiform beak 3–4.5 mm long. Pappus of many barbellate white bristles, 3–4 mm long.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal), Hajar mountains, moist rocky slopes; rare. *Altitude*: 200–? m. Distributed in mainland Asia from Afghanistan across C Asia to the Tien Shan and across Pakistan to the eastern Himalaya. Elsewhere in the Arabian Peninsula so far only known from the mountains of western Saudi Arabia.

Distribution map & Illustration: 827.

2. ***Lactuca inermis*** Forssk., Fl. Aegypt.-Arab.: 144 (1775).
Type: Yemen, *J.R.I. Wood* 75/833 (neotype, BM).
Synonyms: *Lactuca capensis* Thunb. (1800); *Lactuca yemensis* Deflers (1889).

Description: Perennial herb with white latex, to more than 1 m high, with one stem or several, somewhat glaucous. Leaves mainly in the lower portion of the stem, up to 20 cm long, narrowly lanceolate, entire or sinuate-dentate and up to 2 cm wide, sometimes pinnately lobed with lobes to 3 cm long. Capitula ligulate, with up to ± 15 flowers; in a paniculiform synflorescence. Involucre narrowly cylindric, at anthesis ± 8–10 mm, at fruiting up to 18 mm long. Flowers bluish or whitish. Achenes (including beak) 4.5–8 mm long, body reddish brown, strongly compressed, 1-ribbed on either side and wrinkled, ± 3–5 mm long, the white to greenish-white, filiform beak 1.5–3.5 mm long. Pappus of many barbellate white bristles, 5–7 mm long.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Hajar mountains, on damp and shaded rocky slopes, wadi beds; rare. *Altitude*: 400–? m. Widely distributed in sub-Saharian Africa and the Arabian Peninsula. Elsewhere in the Arabian Peninsula only know from the mountains in SW Saudi Arabia and Yemen.

Distribution map & Illustration: 828.

Notes: This widespread species has its eastern limit of distribution in Northern Oman. Its occurrence in the Hajar mountains seems to be a relic of a former wider distribution in the southern Arabian Peninsula. The current nearest known occurrence is in the western mountains of the Peninsula. The type locality is given as Yemen: Kusmah (Kurmae), 1763, but no original material is extant (Hepper & Friis, The Plants of Pehr Forsskal, 1994: 125).

3. ***Lactuca orientalis*** (Boiss.) Boiss., Fl. Orient. 3: 819 (1875).
Basionym: *Phaenopus orientalis* Boiss. (1841)

Description: Spinescent subshrub with white latex, up to ± 60 cm high, stems whitish, intri-

cately and divaricately branched. Leaves glaucous green; basal leaves rosulate, up to 12 × 20 mm, sinuate-dentate to pinnately lobed with triangular, acute, retrorse lobes; stem leaves increasingly smaller and less incised towards stem apex, with linear, adnately long-decurrent auricles. Capitula ligulate, solitary, on peduncles remaining as spines after the shedding of the capitula, or laterally sessile; with 4 flowers. Involucre narrowly cylindric, at anthesis 8–10 mm, at fruiting up to 16 mm long. Flowers pale yellow. Achenes pale brown, 7–9 mm long, narrowly ellipsoidal, including a 2 3 mm long, concolorous beak. Pappus of many barbellate, white, easily caducous bristles 7–8 mm long.

Flowering and fruiting: February to April(?).

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal), in silt among rocks, including field margins; locally common. *Altitude*: 500–1900 m. Distributed in E Mediterranean, SW and C Asia. Elsewhere in the Arabian Peninsula found in adjacent UAE (Musandam).

Distribution map & Illustration: 829.

Notes: The species was first recorded for the Arabian Peninsula from Oman and UAE by Gary Feulner in 1994, who also contributed the distribution and habitat data from Ru'us al-Jibal.

16. **Launaea** Cass.

54 species, distributed mainly in Africa and SW to S and C Asia, further in Mediterranean Europe and W Australia, one species introduced to the Caribbean and adjacent regions. The Horn of Africa region and the southern Arabian Peninsula are the centre of diversity of the genus; 11 species present in Oman.

1. Cushion forming, spinescent, intricately and divaricately branched shrublet ..... 2. **L. bornmuelleri**
   Plant neither spinescent nor shrubby, annual or perennial herbs or subshrubs 2
2. Marginal achenes never papillose, with winged ribs or sharply wrinkled and mostly blackish 3
   Marginal achenes papillose (lense!), neither sharply wrinkled nor with winged ribs ... 6
3. Plants procumbent or almost acaulescent, frequently with clustered capitula; pappus of uniform bristles, caducous as a whole together with the pappus disk, the achenes then with distinctly pointed apex 4
   Annuals with leafy or occasionally leafless, usually single, erect stem; pappus persistent of downy outer hairs and inner bristles; marginal achenes very shortly beaked 5
4. Capitula subglobose; marginal achenes with winged ribs ..... 3. **L. capitata**
   Capitula slender; marginal achenes with narrow ribs, not winged ..... 11. **L. procumbens**
5. Capitula on divaricating, capillaceous branches, all pedunculate, never clustered; involucre with 5 inner phyllaries ..... 8. **L. massavensis**

Capitula on virgate or wiry branches, partly sessile, at fruiting frequently clustered; involucre with 8 phyllaries (rarely more) ..... 7. **L. intybacea**

6. Flowering stems leafy, leaves clasping the stem 7
Flowering stems leafless or if leafy then leaves with non-clasping, petiole-like, semi-amplexicaule base 8

7. Plant green; achenes attenuate at apex or rostrate; Southern Oman only ..... 5. **L. crassifolia**
Plant conspicuously greyish-glaucish; achenes truncate at apex; Northern Oman only ..... 9. **L. mucronata**

8. Robust erect perennial or subshrub; leaves sinuate-dentate; achenes bulky, with stiff, coarse, brown papillae; pappus of cottony hairs ..... 4. **L. castanosperma**
More delicate perennials; leaves sinuate-dentate to pinnatifid; achenes slender, with soft, whitish papillae; pappus of downy outer hairs and inner bristles, or of rather uniform bristles only 9

9. Leaves pinnatifid to bipinnatifid; achenes stout and truncate; pappus of rather uniform bristles only ..... 6. **L. hafunensis**
Leaves sinuate-dentate to pinnatifid; achenes slender and with a distinct beak; pappus of downy outer hairs and inner bristles 10

10. Flowering stem(s) usually leafy, usually erect; peduncles mostly 2–8 cm long; anther tube without appendages 2.6–3.2 mm long; pappus 9–12 mm long, persistent; Northern Oman only ..... 10. **L. omanensis**
Flowering stems always leafless, ascending; peduncles usually 0.5–2 cm long; anther tube without appendages 1.8–2.4 mm long; pappus 5–9 mm long, caducous; Southern Oman only ..... 1. **L. almahrahensis**

1. ***Launaea almahrahensis*** N.Kilian, Englera 17: 339 (1997).
Type: Yemen, Hadramaut, Umgebung von Nitaua ... bei Ras Fartak, 7./8.3.1899, *Paulay* (holotype, WU).

Description: Perennial rosette herb with white latex, 10–20 cm high, with procumbent to ascending, divaricately branched, leafless flowering stems. Rosette leaves up to 9 × 2.5 cm, obovate to spatulate, sinuate-dentate to pinnatipartite with rounded segments, margins denticulate. Capitula ligulate, single at the end of the branches, peduncles 0.5–2.5 cm long. Involucre at flowering 9–11 mm at fruiting up to 13(–16) mm long; phyllaries contracted into a white tip. Flowers yellow. Achenes, including a short beak of 0.3–0.5 mm length, ± 4 mm long, inner ones glabrous, marginal ones covered with minute dustgrain-like and 0.1–0.2 mm long, spreading, linear-lanceolate papillae. Pappus 5–9 mm long, caducous, of downy hairs and bristles.

Flowering and fruiting: October to March.

Distribution and habitat: Southern Oman, Dhofar, Jazir Coast; rocky, gravelly and sandy ground, on slopes, plains and in wadi beds. *Altitude*: ± 100–? m. Elsewhere in the Arabian Peninsula found in S Yemen.

Distribution map & Illustration: 830.

Notes: The species is endemic to the South Arabian mountain ranges between Shuqra, Yemen, in the west, and Ras Madrakah, Oman, in the east. In S Yemen the species is know from altitudes at up to 1100 m.

2. ***Launaea bornmuelleri*** (Hausskn. ex Bornm.) Bornm., Beih. Bot. Centralbl., Abt. 2, 60: 226 (1939).
Basionym: Zollikoferia bornmuelleri Bornm. (1894). *Synonym*: *Launaea spinosa* auct., non (Forssk.) Kuntze
Vernacular names: qishqish, khabaath.

Description: Spinescent, intricately and divaricately branched shrublet with white latex, forming dense cushions to 30 cm high. Leaves only on young branches, to 8 × 2 cm, spatulate, denticulate and sinuate-dentate to pinnatipartite. Flowering branches divaricately branched and zig-zag-forming; peduncles subulate, remaining as spines after shedding of the capitula. Capitula ligulate. Involucre 8–12 mm long, with 5 inner phyllaries, all with scarious margin. Flowers bright yellow. Achenes 3–4 mm long, smooth to wrinkled, glabrous. Pappus 6–7 mm long, of downy hairs and bristles.

Flowering and fruiting: September to June.

Distribution and habitat: Northern and Southern Oman, Musandam (Ru'us al-Jibal), Hajar mountains and foothills, and along the coast and on the off shore islands to Dhofar; in rocky habitats. *Altitude*: 0–2000 m. The species is distributed from the island of Hormoz, off the Iranian coast in the Strait of Hormoz, across the southern Arabian Peninsula to N Somalia. Elsewhere in the Arabian Peninsula in UAE, Yemen.

Distribution map & Illustration: 831.

Notes: The species has usually been misidentified as *Launaea spinosa* (Forssk.) Kuntze, an only habitually superficially similar species restricted to the coastal mountains of the northernmost part of the Red Sea.

3. ***Launaea capitata*** (Spreng.) Dandy in Andrews, Fl. Pl. Anglo-Egypt. Sudan 3: 40 (1956).
Basionym: *Chondrilla capitata* Sieber ex DC. (1838). *Synonyms*: *Zollikoferia glomerata* Boiss. (1875); *Microrhynchus glomeratus* Jaub. & Spach (1848); *Launaea glomerata* Hook.f. (1881).
Vernacular names: hawa, hudhan, huwwa.

Description: Annual rosette herb with white latex and clustered, subsessile capitula in the centre of the rosette or with a few to several procumbent to ascending or erect flowering stems up to 15(–40) cm long and with distally clustered capitula. Rosette leaves up to 15 × 5 cm, spatulate, sinuate-dentate to runcinate, margins denticulate. Capitula ligulate, globose, nodding at fruiting. Involucre 8–12 mm long, phyllaries with distinct, broad scarious margins. Flowers bright yellow. Achenes 3–4.5 mm long, pericarp of soft tissue, winged. Pappus 4–7 mm long, of bristles caducous together with the pappus disk.

Flowering and fruiting: December to May in Northern Oman; September to February (?) in Southern Oman; in suitable habitats perhaps also beyond these months.

Distribution and habitat: Scattered all over Oman; usually found in sands, sandy soil, or silt in desert habitats, also as a harmless weed in irrigated fields. *Altitude*: 0–1000 m. Distributed from the eastern Canary Islands across the deserts of N Africa , the Arabian Peninsula, Iraq, SE Iran, Afghanistan, Pakistan to N India (Hissar). Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration: 832.

4. ***Launaea castanosperma*** F.G.Davies, Kew Bull. 33: 294 (1979).
Type: "Oman. Dhofar. Derbal", 1895, *J.T. Bent* 233 (holotype, K).

Description: Perennial herb or subshrub with white latex, up to ± 1 m, with a robust, erect, almost leafless, sparingly branched flowering stem. Leaves in a basal rosette or crowded basally, up to 11 × 6 cm, obovate to broadly spatulate with rounded apex, sinuate-dentate and denticulate. Capitula ligulate, single at the end of the branches. Involucre 13–16 mm long, bell-shaped at fruiting. Flowers yellow. Achenes 2.5–3.5 mm long, bulky, inner glabrous and pale, marginal densely covered with stiff, coarse, narrowly triangular brown papillae. Pappus 8–10 mm long, of cottony hairs and a few caducous bristles.

Flowering and fruiting: September to December (?).

Distribution and habitat: Southern Oman, Dhofar, in open rocky or gravelly places of the coastal plain, foothills and coast-near mountains. *Altitude*: 10–1000 m. Elsewhere in the Arabian Peninsula found in SE Yemen.

Distribution map & Illustration: 833.

Notes: The species is endemic to Dhofar and the neighbouring Al-Mahra; apparently by human introduction the species has recently also be observed by roadsides in Hadhramout, Yemen.

5. ***Launaea crassifolia*** (Balf. f.) C.Jeffrey, Kew Bull. 18: 477 (1966).
Basionym: Lactuca crassifolia Balf.f. (1882).

Description: Annual to pauciennial herb with white latex, to 50 cm high with leafy flowering stems. Leaves up to 15 × 7 cm, obovate to lanceolate, sinuate-dentate to irregularly pinnatipartite, except for the basal ones distinctly auriculate. Capitula ligulate. Involucre slender, 8–11 mm long at flowering, up to 15 mm long at fruiting. Flowers bright yellow. Achenes 3–6 mm long, apically attenuate or with a stout beak to 1/3 of the achene length, glabrous (the innermost ones) to densely papillose (the marginal). Pappus 4–7 mm long, of downy hairs and bristles, or of bristles only and caducous.

Flowering and fruiting: September to January (?).

Distribution and habitat: Southern Oman, Dhofar; in open types of vegetation and preferably in damp rocky habitats, often on calcareous ground. *Altitude*: 0–1500 m. The species

is endemic to the Horn of Africa region (N Somalia) and central S Arabia. Elsewhere in the Arabian Peninsula found in SE Yemen; also found on Soqotra.

Distribution map & Illustration: 834.

6. ***Launaea hafunensis*** Chiov., Fl. Somala 1: 207 (1929).
Synonym: *Crepis* sp., Miller & Morris, Pl. Dhofar: 294 (1988).
Vernacular name: hamhám.

Description: Greyish to glaucish perennial herb with white latex to ± 25 cm high, with a globose tuber ± 2–3 cm in diameter placed 5–15 cm under ground, with divaricately branched, erect stems. Leaves to 6(–10) × 3(–5) cm, obovate to spatulate, basally crowded, sinuate-dentate to pinnatisect or bipinnately divided with narrow segments. Capitula ligulate. Involucre cylindric, 10–13 mm long, thinly farinaceous, phyllaries with scarious margins. Flowers bright yellow. Achenes 2.5–5 mm long, inner glabrous, marginal densely papillose. Pappus 7–9 mm long, of almost uniform bristles.

Flowering and fruiting: September to December (?).

Distribution and habitat: Southern Oman, Dhofar, on rocky coastal plains and predesert zone of the mountainous stony plateaus. *Altitude*: 50–1000(?) m. The species is distributed across the coastal mountains of the central southern Arabian Peninsula to Somalia, eastern Ethiopia and the Rift Valley area in Kenya and N Tanzania. Elsewhere in the Arabian Peninsula found in SE Yemen.

Distribution map & Illustration: 835.

Notes: In Oman the species seems very rare today but was formerly very common and the sweet and juicy tuber was dug out and eaten by local people (Miller & Morris 1988: 334). It is assessed here as Vulnerable [A1 (d)] on the National Red List.

7. ***Launaea intybacea*** (Jacq.) Beauverd, Bull. Soc. Bot. Genève 2: 114 (1910).
Basionym: *Lactuca intybacea* Jacq. (1784). *Synonym*: *Launaea remotiflora* (DC.) Amin ex Rech.f. (1977).

Description: Annual herb with white latex, with erect stems, leaves in a basal rosette or stems leafy in lower part. Basal leaves obovate to spatulate, obtuse to acute, sinuate-dentate to runcinate; stem leaves smaller, lanceolate, sagittately auriculate. Flowering branches spreading-erect, usually virgate, with many capitula. Capitula ligulate, on wiry, short peduncles to sessile, at fruiting often clustered at the nodes. Involucre slender, 9–13 mm long, with 8 inner phyllaries with scarious margins. Flowers pale yellow; anther tube without appendages 1.1–1.3 mm long. Achenes 3–4.5 mm long, the inner greyish, weakly wrinkled, attenuate to shortly rostrate, the marginal usually black, sharply wrinked, with a beak 1/8–1/4 of the achene length. Pappus 7–8 mm long, of downy hairs and bristles.

Flowering and fruiting: January to April in Northern Oman, September to December (?) in Southern Oman.

Distribution and habitat: Northern Oman, Hajar mountains, Southern Oman, Dhofar in open habitats, wadi beds, as a ruderal and harmless weed. *Altitude*: 0–600 m. Probably indigenous only in (western) Arabian Peninsula and neighbouring parts of Africa; elsewhere widely distributed in a scattered way in subtropical and the drier parts of tropical Africa, in S Iran at the Straits of Hormoz and on the Indian subcontinent, and definitely introduced in the Carribean and adjacent areas. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 836.

8. ***Launaea massavensis*** (Fresen.) Kuntze, Revis. Gen. Pl. 1: 351 (1891).
Basionym: Heterachaena massavensis Fresen. (1839).

Description: Annual herb with white latex, 15–70 cm high, usually with a single, erect, leafy flowering stem, densely and divaricately branched distally. Basal leaves crowded, up to 18 × 6 cm, ovate to spatulate, sinuate-dentate to deeply lyrate or runcinate, with rounded apex; cauline leaves deeply clasping the stem, otherwise similar. Capitula ligulate, all on capillaceous peduncles 1–3 cm long, with 7–14 flowers only. Involucre 7–10 mm long, slender, with 5 inner phyllaries. Flowers pale to medium yellow, anther tube without appendages 0.8–1.2 mm long. Achenes 2–4 mm long, the inner smooth to slightly wrinkled, pale, the marginal sharply wrinkled, dark brown to black. Pappus 4–5.5 mm long, of downy hairs and bristles.

Flowering and fruiting: February to May in Northern Oman; September to November in Southern Oman.

Distribution and habitat: Northern Oman, Musandam Peninsula (Ru'us al-Jibal) and Hajar mountains, common; Southern Oman, Dhofar, on damp rocky slopes, hillsides, wadi beds, on various substrates. *Altitude*: 20–1300 m. Distributed from the Ethiopian Highlands and coastal mountainous Eritrea and Sudan along the southwestern and southern mountains of the Arabian Peninsula to Musandam and the coastal areas on the Iranian side of the Straits of Hormoz. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 837.

9. ***Launaea mucronata*** (Forssk.) Muschl., Man. Fl. Egypt 2: 1057 (1912).
Basionym: Leontodon mucronatus Forssk. (1775).
Vernacular name: atheed.
Description: Conspicuously greyish-glaucous annual herb with white latex, with an erect stem to 50 cm high, divaricately branched distally. Cauline leaves spatulate, irregularly deeply pinnately divided, with narrow, acute segments, acute apex and cochleate, pinnatifid, auriculate base, margin sinuate-dentate and undulate. Capitula ligulate, on peduncles mostly 3–6 cm long. Involucre at flowering 8–12 mm, at fruiting up to 16 mm long; phyllaries with indistinct or no scarious margin and a white tip. Flowers bright yellow. Achenes

3–7 mm long, the inner with papillose wrinkle lines and with a slightly ventricose tubular base, the marginal densely papillose.

Pappus 6–9 mm long, persistent, of downy hairs and bristles ..... a. subsp. ***mucronata***
Pappus 4–7(–9) mm long, caducous, of ± 20–30 bristles only ..... b.subsp. ***cassiniana***

a. subsp. ***mucronata***

Flowering and fruiting: February to May.

Distribution and habitat: Northern Oman, W Hajar Mountains, mainly on sandy or silty substrates, in wadi beds, sometimes as a ruderal or weedy; rare. Distributed from the eastern Canary Islands across the desert and semidesert regions of N Africa and the northern and central Arabian Peninsula to Iraq, W and S Iran. Elsewhere in the Arabian Peninsula fiund in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration: 838.

b. subsp. ***cassiniana*** (Jaub. & Spach) N.Kilian, Willdenowia 25: 177 (1995).
Synonym: *Launaea cassiniana* (Jaub. & Spach) Kuntze (1891).

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, W Hajar Mountains, presence within the borders of Oman uncertain; mainly on sandy or silty substrates, in wadi beds, sometimes as a ruderal or weedy; rare. Distributed from across the desert regions of N Africa and the central Arabian Peninsula to S Iran opposite Musandam Peninsula. Elsewhere in the Arabian Peninsula found in Saudi Arabia and UAE.

Distribution map & Illustration: 839.

10. ***Launaea omanensis*** N.Kilian, Englera 17: 343 (1997).
Type: Oman, Buraimi region, 4 km ENE of Mahdah, ± 200 m, 28.4.1989, *R.I. Western* 1182 (holotype, E)

Description: Perennial herb with white latex, 20–50 cm high with a single erect, at least basally leafy, or a few such stems. Basal leaves up to 13 × 2 cm, variable, narrowly spathulate to elliptic, sinuate-dentate to pinnatifid with narrow acute segments; stem leaves similar but smaller, narrower and less incised. Capitula ligulate, single at the end of the branches, peduncles (1–)2–8 cm long. Involucre at flowering 11–15 mm, at fruiting 15–18 mm long; phyllaries mucronate, the outer with white tip. Flowers yellow. Achenes 4–7 mm long, including a slender beak of 1–2 mm, inner ones glabrous, marginal covered with minute dustgrain-like and 0.1 mm long, spreading, linear papillae. Pappus 9–12 mm long, of downy hairs and bristles.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Hajar mountains and coastal plains on rocky slopes and wadi beds. *Altitude*: 0–1800 m.

Distribution map & Illustration: 840.

Notes: The species is endemic to Northern Oman and has been earlier misidentified as *Launaea mucronata,* from which it is, however, clearly distinct.

11. ***Launaea procumbens*** (Roxb.) Ramayya & Rajagopal, Kew Bull. 23: 465 (1969).
Basionym: Prenanthes procumbens Roxb. (1832).
Vernacular names: huwah, moraar, howthan, hagaid.

Description: Perennial rosette herb with white latex, with several procumbent to ascending, leafy to leafless, very shortly to virgately branched flowering stems 20–40 cm long, often with rosulate leafy innovations at basal stem nodes. Rosette leaves up to 15 × 4 cm, spatulate, sinuate-dentate to variously pinnately divided; stem leaves with clasping base. Capitula ligulate, often clustered at the nodes, sessile or with peduncles rarely longer than 1 cm. Involucre 8–14 mm long; phyllaries with distinct, broad scarious margins. Flowers yellow. Achenes. 2–4 mm long, pericarp of soft tissue, the inner stout columnar, pale, the marginal pale to greyish, brownish or blackish, usually wrinkled. Pappus of bristles, caducous together with the pappus disk.

Flowering and fruiting: In suitable habitats almost all around the year.

Distribution and habitat: Probably throughout the coastal areas of Oman; recorded from Northern Oman (Musandam?, Hajar mountains and coastal plains) and Southern Oman (Dhofar), in preferably desert-like sandy or gravelly places, with some degree of salt tolerance, but most frequently as a weed and ruderal species. *Altitude*: 0–1000(?) m. Distributed from Egypt across the Arabian Peninsula eastwards to the central Asian Aralo-Caspian lowland area and NW China, and southeastwards across Afghanistan, Pakistan, N India, Nepal, N Burma to SW China. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 841.

17. **Reichardia** Roth
Eight species, distributed from the Canary Islands across the Mediterranean and extending to SW Asia and tropical NE Africa.

Reichardia tingitana (L.) Roth, Bot. Abh. Beobacht.: 35 (1787).
Basionym: *Scorzonera tingitana* L. (1753). *Synonyms*: *Reichardia orientalis* (L.) Hochr. (1904); *R. arabica* (Hochst. & Steud. ex DC.) Fiori (1913); *R. tingitana* var. *arabica* (Hochst. & Steud. ex DC.) Asch. & Schweinf. (1887).
Vernacular names: huwah, morrar, baqrw, mutranee, maknan, halawla.

Description: Annual herb with white latex, almost acaulescent or up to 20 cm, rarely more, glabrous, initially with basal leaf rosette, later stretching to a + leafy, erect, scarcely branched stem. Leaves to 12 × 3 cm, spatulate, sinuate-dentate to pinnatifid and dentate, basally auriculate, apically attenuate to acute. Capitula ligulate, single at the end of the

branches. Peduncles swollen below the capitulum. Involucre 8–14 mm long, phyllaries with conspicuously broad scarious margins, the outermost ovate, imbricate, the inner linear-lanceolate, in one row, of equal length. Flowers yellow, corolla sometimes with reddish base, or tips. Achenes pale 1.5–4 mm long, coarsely tuberculate. Pappus 6–9 mm long, white, of thin bristles, caducous.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam and Hajar mountains, on gravel in wadis and plains, on rocky slopes, locally common. *Altitude*: up to ± 1200 m. Distributed from the Canary Islands across the Mediterranean to NE tropical Africa and NW India. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 842.

18. **Sonchus** L.

Close to 90 species in its wider circumscription including several former segregates, distributed with centres of diversity in the mid-Atlantic archipelagos, the W Mediterranean and E Africa, in Eurasia, Africa, Australia and New Zealand; a few weedy and ruderal species are introduced widely beyond.

Perennial herb; leaves almost ribbon-like to linear-elliptic or -lanceolate, sinuate-dentate, base clasping the stem with roundish auricles ..... 1. **S. maritimus**

Annual herb; leaves mostly lanceolate in outline, coarsely dentate to pinnatifid with acute segments and sinuate-dentate, base clasping the stem with acute auricles ..... 2. **S. oleraceus**

1. ***Sonchus maritimus*** L., Syst. Nat., ed. 10: 1192 (1759).

Description: Perennial herb with shoot bearing roots and white latex. Stems erect to 50 cm tall, leafy, little branched in upper part. Leaves almost ribbon-like to linear-elliptic or -lanceolate, rarely more than 2 cm wide, sinuate-dentate, clasping the stem with roundish auricles. Peduncles usually glabrous. Capitula ligulate, by few at the end of the branches. Involucre 12–15 mm long, of numerous green, imbricate phyllaries, ± glabrous. Flowers numerous, yellow. Achenes compressed, 2.5–3 mm long, elliptisoidal, ribbed and with smooth surface. Pappus 6–8 mm long, white, of numerous downy and few thicker and longer hairs, easily caducous.

Flowering and fruiting: In suitable sites probably all year.

Distribution and habitat: Northern Oman, Hajar mountains, in wet and shaded ground along irrigation ditches, etc. *Altitude*: 1500(?)–2000 m. Distributed in the Mediterranean and western Irano-Turanian region, beyond this introduced in southern Africa and E Australia. Elsewhere in the Arabian Peninsula found in NE Saudi Arabia.

Distribution map & Illustration: 843.

2. ***Sonchus oleraceus*** L., Sp. Pl.: 794 (1753).
Vernacular names: odeid, adheed, dalaween, khas al waz, khuwaysh, hawa, galawein.

Description: Annual herb with white latex. Stems erect, to 1 m tall, leafy, little branched in upper part. Leaves mostly lanceolate in outline, coarsely pinnatifid with acute segments and sinuate-dentate, clasping the stem with acute auricles. Peduncles often somewhat glandular and/or white-woolly below the capitulum. Capitula ligulate, by few or several at the end of the branches. Involucre 8–12 mm long, of numerous green, imbricate phyllaries, often ± glandular and/or basally white-woolly. Flowers numerous, yellow. Achenes compressed, 2.5–3.5 mm long, cuneate in outline, ribbed and with warty, tuberculate surface. Pappus 5–8 mm long, white, of numerous downy and few thicker and longer hairs, ± persistent.

Flowering and fruiting: In suitable sites all year.

Distribution and habitat: Northern Oman, a widespread weed of (irrigated) gardens and fields and as a ruderal. *Altitude*: 0–2000 m. An almost cosmopolitan weed and ruderal. Elsewhere in the Arabian Peninsula in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 844.

Species expected to occur in Oman

Sonchus asper (L.) Hill, an annual to biennial herb to 1 m or more, with coarsely dentate to pinnatifid leaves with conspicuously long, densely dentate margins and roundish auriculate base, and with compressed, ribbed, largely smooth and winged achenes, is known as a weed from most countries of the Arabian Peninsula including UAE and Saudi Arabia. No record from Oman seen, but its occurrence is likely.

19. **Urospermum** Scop.
Two species, distributed in the Mediterranean and SW Asia; one species widespread beyond as a weed and ruderal.

Urospermum picroides (L.) F.W.Schmidt, Samml. Phys.-Ökon. Aufsätze 1: 275 (1795).
Basionym: Tragopogon picroides L. (1753).
Vernacular names: uddaidha, salis, 'adheed, khioach.

Description: Annual herb with white latex to 40 cm tall, with sparingly branched stem. Basal leaves rosulate, up to 14 × 4 cm, obovate to oblanceolate, almost entire to pinnatifid, hispid to spinulose of simple bristles; stem leaves lanceolate, auriculate, smaller, otherwise similar. Capitula ligulate, solitary at the end of the branches. Involucre 15 mm long at anthesis, more than 20 mm long at fruiting; phyllaries in one row, connate in basal third, subequal, spinulose of simple bristles. Flowers pale yellow. Achenes almost straight to s-shaped, with a long, slender beak distinctly longer than the 4–5 mm long body. Pappus with plumose bristles, 9–12 mm long, caducous.

Flowering and fruiting: (November) January to April, in irrigated fields also at other times.

Distribution and habitat: Northern Oman, Musandam, Hajar mountains and coastal lowlands, particularly as a weed in irrigated fields. *Altitude*: 50–1500 m. Originating from the E Mediterranean and SW Asia, the species is introduced to cultivated areas of the entire Mediterranean and adjacent regions, in the Middle East eastwards to Pakistan, in Africa south of the Sahara and in South America. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, in scattered localities in Saudi Arabia, as a weed of irrigated cultures in the highlands of Yemen, UAE.

Distribution map & Illustration: 845.

IV. **Tribe Vernonieae**

20. **Vernonia** Schreb.

Some 700 species in its traditional, wide circumscription as a pantropical genus of trees, shrubs and herbs, which is not supported by the contemporary systematics of the tribe Vernonieae, according to which the genus comprises only 22 New World species. Since no systematic revision at species rank is available for the Old World, the traditional concept of *Vernonia* is maintained here for the time being for pragmatic reasons.

1. Herb with fresh green leaves and green branches ..... 3. **V. cinerea**
   Shrub or dwarf shrub with greyish-green, tomentose leaves and greyish-green to pale, white-tomentose young branches 2
2. Cushion forming dwarf shrub; leaves with a few teeth or lobes; pappus with an outer row of narrowly ovate-lanceolate scales up to 0.8 mm long ..... 1. **V. arabica**
   Shrub to over 1 m tall; leaves entire; pappus with an outer row of up to ± 1 mm long, linear, almost bristle-like scales ..... 2. **V. cinerascens**

1. ***Vernonia arabica*** F.G.Davies, Kew Bull. 32: 775 (1978).
Synonym: *Vernonia atriplicifolia* auct., non Jaub. & Spach (1852).
Vernacular names: kibb (Arabic); siot (Jibbali); yilbeen (Harsusi).

Description: Cushion forming dwarf shrub, intricately and divaricately branched, up to 30 cm (rarely over 50 cm) tall. Leaves mostly (much) less than 2 × 1.5 cm (rarely, in the moist escarpments of southern Dhofar, up to 5 × 2 cm), ovate to rhomboid, attenuate into a cuneate to petiol-like base, obtuse to acute, with 1–3 teeth or lobes on either side, greyish-green, tomentose. Capitula discoid, with 10–30 flowers; in corymbose synflorescences. Involucre 4–8 mm long, phyllaries rather variable, lanceolate, acute, upper portion and margin often tinged purplish. Flowers purple, all perfect, tubular. Achenes 1–2 mm, pubescent. Pappus pure white, with an outer row of narrowly ovate-lanceolate scales up to 0.8 mm and an inner row of 3–5 mm bristles.

Flowering and fruiting: September to May(?).

Distribution and habitat: All across Oman from Musandam to Dhofar, usually in open, rocky places. *Altitude*: 150–1900(?) m. Distributed in N Somalia and southern Arabia. Elsewhere in the Arabian Peninsula found in Yemen, UAE.

Distribution map & Illustration: 846.

Notes: The species has long been confused with *Vernonia spatulata* (Forssk.) Sch. Bip. (= *V. atriplicifolia* Jaub. & Spach), which is, so far known, restricted to Yemen. *V. spatulata* also has lobed leaves and a greyish tomentose indumentum but is easily distinguished from *V. arabica* by its cream, straw-coloured to rufous (versus pure white) pappus with an outer row of 0.2 mm long scales longitudinally dissected almost from the base (versus ovate-lanceolate, up to 0.8 mm long, apically dissected scales) and a more robust and subspinescent (versus rather delicate) habit. In Yemen *V. spatulata* extends eastwards as far as Al-Mahra, in localities close to the border with Oman. It is therefore not unlikely that the species also occurs in the little explored westernmost parts of Dhofar. Usually *Vernonia arabica* is rather compact and small-leaved, in moist places of the Dhofar fog oases (e.g. moist cliffs at Jebal Qamar), however, conspicuously large-leaved plants (leaves up to 5 × 2 cm) with a more diffuse and taller growth (more than 0.5 m) occur. Otherwise, the plants are not different and we see no justification for a formal taxonomic recognition at an infraspecific rank.

2. ***Vernonia cinerascens*** Sch.Bip. in Schweinfurth, Beitr. Fl. Aethiop.: 162 (1867).
Synonym: *Orbivestus cinerascens* (Sch.Bip.) H.Rob. (1999).

Description: Shrub to over 1 m tall, branches pale and white-tomentose, glabrescent and becoming blackish-brown with age. Leaves up to 3 × 1.5 cm, greyish-green, obovate to spatulate, with attenuate or cuneate base and obtuse or rounded apex, (sub)entire, finely adpressed-pubescent. Capitula discoid, in divaricate corymbose synflorescences. Involucre 3–5 mm long, phyllaries ovate to linear-lanceolate or -spatulate, greyish-green, apically purplish, obtuse, acute or ± apiculate, pubescent and somewhat glandular. Flowers purple, all perfect, tubular. Achenes 2–3 mm long, pubescent. Pappus white, with an outer row of up to 1 mm long, linear, almost bristle-like scales, and an inner row of 3–4 mm long bristles.

Flowering and fruiting: September to December(?).

Distribution and habitat: Southern Oman, Dhofar, rocky slopes of the lower sea-facing escarpment in *Commiphora-Boswellia-Delonix* woodland, and rocky slopes and plateau areas of the higher escarpment in *Euphorbia balsamifera* scrub. *Altitude*: mainly 100–400 m and 1000–1400 m. Distributed in the drier parts of tropical Africa (largely corresponding to the Sudano-Zambesian region), in southern Africa, Arabian Peninsula and NW India. Elsewhere in the Arabian Peninsula found in southwestern Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 847.

Notes: The species reaches its eastern distributional limits on the Arabian Peninsula in

Southern Oman and is here reported for the first time from Oman based on collections by P. Hein and N. Kilian made in 1998.

3. ***Vernonia cinerea*** (L.) Less., Linnaea 4: 291 (1829).
Basionym: Conyza cinerea L. (1753). *Synonym*: *Cyanthillium cinereum* (L.) H.Rob. (1990).
Vernacular name: kibb.

Description: Annual to pauciennial herb, to over 50 cm high. Stems erect, leafy, branched. Leaves to 6 × 2.5 cm (also larger, if in Oman?), variable in shape, obovate to spatulate or lanceolate, attenuate into a petiol-like base, margins serrate, fresh green, somewhat pubescent. Capitula discoid, numerous in compound corymbose synflorescences. Involucre 3–5 mm long; phyllaries linear-lanceolate, attenuate into an acute, often purplish tip, otherwise green, pubescent and somewhat glandular. Flowers purple, all perfect, tubular. Achenes 2–3 mm long, pubescent. Pappus white, with an outer row of linear to linear-lanceolate, up to 0.6 mm long scales and an inner row of ± 3–5 mm long bristles.

Flowering and fruiting: Almost throughout the year.

Distribution and habitat: Northern Oman, scattered on the Batinah plain, widespread in the Hajar mountains; Southern Oman, Dhofar. Probably scattered throughout the country, a ruderal species and weed of cultivated or disturbed sites. *Altitude*: 0–700(?) m. Widespread in the Old World tropics and widely introduced in other tropical and subtropical regions. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen, UAE.

Distribution map & Illustration: 848.

Notes: Introduced and naturalised.

V. **Tribe Senecioneae**

21. **Euryops** (Cass.) Cass.
97 species, all distributed in Africa, mostly southern Africa, with one species extending into the Arabian Peninsula.

Euryops arabicus Steud. ex Jaub. & Spach, Ill. Pl. Orient. 4: 88, t. 355 (1852).
Synonyms: *Euryops socotranus* Balf.f. (1882); *E. pinifolius* auct., non A.Rich.
Vernacular names: hanqalan, hayqalan.

Description: Shrub to 80 cm. Leaves up to 6 × 0.6 cm, linear to linear-lanceolate, usually unlobed, entire, somewhat coriaceous. Capitula radiate, on 2–6 cm long peduncles in the upper leaf axiles of the branches. Involucre hemispherical, 5–10 mm wide, of 6–10 lanceolate phyllaries in one row, connate to the middle. Flowers yellow; ray flowers 6–11, ray lamina 4–8 mm long; tubular flowers 20–30. Achenes 3–4 mm long, sericeous. Pappus of numerous white, flexible bristles up to 3 mm long.

Flowering and fruiting: Almost throughout the year.

Distribution and habitat: Northern Oman, Hajar mountains on the summit, wadi banks and rocky slopes; forms an important element of the shrub vegetation at medium and high elevations. *Altitude*: 1000–3000 m. Distributed on the coastal mountains of the Horn of Africa (N Somalia and Djibouti), on Soqotra and in the Arabian Peninsula. Elsewhere in the Arabian Peninsula in SW Saudi Arabia, Yemen.

Distribution map & Illustration: 849.

Notes: The populations on the Hajar mountains represent the isolated, easternmost outpost of the species, and are apparently relics of a former, wider distribution in the southern Arabian Peninsula. The species is avoided by the livestock.

22. **Kleinia** L.

About 50 species, distributed from the Canary Islands across the drier parts of tropical Africa, Madagascar and the Arabian Peninsula to the Indian Subcontinent.

1. Stems slender, 1–1.5 cm in diameter, cylindric, erect; nodes not raised and with 3 deeper or purplish green radiating lines; flowers white, 6–12 per capitulum ..... 2. **K. odora**
   Stems stout, > 3 cm in diameter, decumbent, procumbent or erect; nodes usually raised to prominent mounds and with 5–9 deeper or purplish-green radiating lines; flowers >30 per capitulum, red or yellow to orange 2
2. Nodes with 5–7 radiating lines; flowers red ..... 3. **K. saginata**
   Nodes with 7–9 radiating lines; flowers yellow to orange ..... 1. **K. mccoyi**

1. ***Kleinia mccoyi*** L.E.Newton, Cact. Succ. J. (Los Angeles) 74: 217 (2002).
Type: Oman, Dhofar, 560 m, 31.10.2001, *McCoy* 2374 (holotype, MO; isotype, P).
Synonyms: *Kleinia lauchsii* Lavranos & T.A.McCoy (2003); *K. butleri* Lavranos & T.A.McCoy (2004).

Description: Pendent to procumbent or erect, glabrous, stem-succulent perennial. Stems stout, up to 7 cm in diameter, jointed, with a first segment of easily 50 cm length, initially erect, later decumbent to well over 1 m long; nodes raised to ± prominent mounds, becoming less prominent with age, and with 7–9 deeper green or purplish-green radiating lines. Leaves only at young shoots, elliptic or linear-lanceolate to linear-spatulate, acute, very variable in size, up to 14 × 2 cm, somewhat fleshy. Capitula discoid, single on 15–60 cm long, apically swollen peduncles arising from the end of the stem. Involucre cylindric, 15–20 mm long, of ± 8–13 linear-lanceolate phyllaries in one row. Flowers ± 30–100, yellow to orange, perfect, tubular. Achenes ± cylindric, 2–4 mm long, villose. Pappus ± 15–22 mm long, of numerous barbellate, white bristles.

Flowering and fruiting: September to February (?).

Distribution and habitat: Southern Oman, western Dhofar on the sea-facing vertical rocky

escarpment and their upper edges. *Altitude*: 500–1250 m. Endemic to westrern Dhofar and eastern El-Mahra, Yemen.

Distribution map & Illustration: 850.

Notes: *Kleinia mccoyi, K. lauchsii* and *K. butleri* all where described from habitats in or close to the huge cliffs (up to 900 m high) facing the sea in western Dhofar between 53°07' and 53°36'E. From the differences given between them (cross sections shape, diameter and growth of the succulent stems as pendent, or procumbent to erect, leaf size and peduncle length, flower colour as lemon yellow, bright yellow or orange-yellow) and the variations observed in cultivation it appears more than doubtful that these morphs deserve recognition at species rank. Further investigations are needed to understand the nature of this variation. Conspicuous is the vigorous growth of the yellow to orange flowered plants, which can also be observed in cultivation, in comparison to the closely related and red flowered (always?) *K. saginata.* Otherwise the differences between the yellow to orange flowered taxa as described seem to represent states of a continuous variation and even the justification of their separation from *K. saginata* may need further attention. For the time being, a single species is here recognised besides *K. saginata* to accommodate the yellow to orange flowered plants.

2. ***Kleinia odora*** DC., Prodr. 6: 339 (1838).

Description: Stem-succulent perennial, branched from the base; stems slender, 1–1.5 cm in diameter, cylindric, erect, jointed, to 1 m high; nodes not raised and with 3 deeper green or purplish-green radiating lines continuing to the next lower node. Leaves on young shoots only, somewhat fleshy, oblong or linear-lanceolate to spatulate, up to 3.5 × 1.5 cm. Capitula discoid, 5–7 in corymbiform synflorescences at the end of the stems. Involucre cylindric, ± 10 mm long, of 5, strongly 3-ribbed phyllaries in one row. Flowers 6–12, white, tubular, perfect. Achenes 2–3 mm long, ± cylindric, villose. Pappus 13–14 mm long, of numerous barbellate, white bristles.

Flowering and fruiting: September to February (?).

Distribution and habitat: Southern Oman, Dhofar, in open rocky or stony habitats such as rocky slopes, wadi banks. *Altitude*: 500–1200 m. Distributed in southern Arabian Peninsula. Elsewhere in the Arabian Peninsula found in SW Saudi Arabia and Yemen.

Distribution map & Illustration: 851.

3. ***Kleinia saginata*** P.Halliday, Kew Bull. 37: 633 (1983).
Type: Oman, Dhofar, 43 km N of Salalah on Thumrait Road, near Aqabat al Hatab, 600 m, rock crevices, 21.9.1977, *Radcliffe-Smith* 5156 (holotype, K).

Description: Erect, sometimes decumbent, glabrous, stem-succulent perennial, up to 40 cm high. Stems stout, up to ± 3–4 cm in diameter, jointed, nodes raised to prominent mounds, becoming less prominent with age, and with 5–7 deeper or purplish green radiating lines.

Leaves only on young shoots, elliptic or linear-lanceolate to linear-spatulate, acute, up to 3 × 1 cm, somewhat fleshy. Capitula discoid, single on 15–30 cm long peduncles arising from the end of the stem. Involucre cylindric, 15–20 mm long, of ± 9–13 linear-lanceolate phyllaries in one row. Flowers ± 30–60, red, perfect, tubular. Achenes ± 3 mm long, ± cylindric, villose. Pappus 16–19 mm long, of numerous barbellate, white bristles.

Flowering and fruiting: June to February (?).

Distribution and habitat: Southern Oman, Dhofar, on the coastal escarpments, on rocky slopes under shrubs, between rocks, and in rock crevices. *Altitude*: 600–1200 m. Distributed in the fog oases of the coastal mountains in the south-central Arabian Peninsula. Elsewhere in the Arabian Peninsula found in the adjacent province of Al-Mahra, Yemen.

Distribution map & Illustration: 852.

Notes: Endemic to Sourthern Oman and SEYemen.

Kleinia pendula (Forssk.) DC., a species distributed in SE Yemen, Somalia, Ethiopia and NE Kenya, was reported erroneously from Dhofar, Oman, due to misidentification of a collection by R. Fiennes, actually referable to *K. saginata* (or *K. mccoyi*?).

Kleinia squarrosa Cufod., which may vegetatively be confused with *K. odora* but is distinguished from that species by its cream to pale violet flowers, has been recently reported from SE Yemen (*Euphorbia balsamifera* zone) and may perhaps also occur in Dhofar.

23. **Senecio** L.

About 1000 species (after a recent revision, but circumscription still not fully settled) of cosmopolitan distribution with centres of diversity in South America (± 500 species) and Africa (± 350 species),

Cauline leaves entire to sinuate-dentate; ray flowers pale yellow, ray lamina 1.5–3.5 mm long ..... 1.**S. breviflorus**

Cauline leaves pinnately to bipinnately lobed; ray flowers bright yellow, ray lamina 6–9 mm long ..... 2. **S. glaucus** subsp. **coronopifolius**

1. ***Senecio breviflorus*** (Kadereit) Greuter, Willdenowia 37: 182 (2007).

Basionym: *Senecio flavus* subsp. *breviflorus* Kadereit (1984). *Synonym*: *Senecio mohavensis* A. Gray subsp. *breviflorus* (Kadereit) M. Coleman (2001).

Vernacular names: sufeira, anhm.

Description: Erect, glabrous and glaucous annual, up to 30 cm high. Leaves up to 4 × 2 cm, widely sinuate-dentate to shallowly lobed, often tinged purplish on lower surface, the lower leaves ovate to spatulate and sessile or attenuate into a petiole-like base, the middle and upper leaves oblanceolate to triangular-cordate and amplexicaule to clasping with rounded auricles. Capitula radiate, in a lax, corymbiform synflorescence. Involucre cylindric, 8 mm

long; outer phyllaries very short; inner phyllaries equal in length and in one row. Flowers yellow; ray flowers pistillate, ray lamina pale yellow, 1.5–3.5 mm long; disk flowers tubular. Achenes 2–3 mm long, subcylindric. Pappus of ray flowers absent, of disk flowers with 4 mm long bristles.

Flowering and fruiting: January to May.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal), Hajar mountains and coastal plains, in wadis and on lower mountain slopes. *Altitude*: 20–600(?) m. Distributed from Sinai, Israel, Jordan and southern Syria eastwards across the Arabian Peninsula to southern Iran and Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen, UAE.

Distribution map & Illustration: 853.

Notes: The species has been confused frequently with *Senecio flavus* (Decne.) Sch. Bip., a southern Mediterranean species distributed from the Canary Islands and Spain to Jordan and Syria. Specimens are also sometimes misidentified as *"S. abyssinicus"*, a species today treated as *Cineraria abyssinica* A.Rich. and confined to the higher mountains of Ethiopia, NW Yemen and SW Saudi Arabia (at altitudes of 2300–4100 m).

2. ***Senecio glaucus*** L.
subsp. ***coronopifolius*** (Maire) C.Alexander, Notes R.B.G. Edinb. 37: 412 (1979).

Synonyms: *Senecio coronopifolius* Desf. (1799), non Burm. f. (1768); *S. desfontainei* Druce (1928).

Vernacular names: zamlooq, qorreis, murair, shakhees, rejet al ghurab.

Description: Annual herb to 30 cm high, glabrous or sparsely arachnoid hairy. Basal leaves lanceolate, entire to pinnatisect with narrow lobes; stem leaves up to 15 cm long, deeply pinnately lobed to bipinnatisect with linear lobes, often with clasping base, upper leaves gradually becoming unlobed and linear. Capitula radiate, in a lax, corymbiform synflorescence. Involucre 5–8 mm long, outer phyllaries very short, inner phyllaries equal in length and in one row. Flowers bright yellow; ray flowers pistillate, ray lamina 6–9 mm long; disk flowers perfect, tubular. Achenes 2–3 mm long, subcylindric. Pappus present on all achenes, of 5–7 mm long bristles.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal), locally common, and rare on the Hajar mountains, on sandy plains, silt among rocks and fallow fields. *Altitude*: 250–1800 m. Distributed in the S Mediterranean area, N Africa and SW Asia to the W Himalaya. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 854.

Notes: The species is a rather frequent and widespread ephemeral in the Arabian Peninsula but only reaches the north-easternmost part of Oman.

VI. **Tribe Calenduleae**

24. **Calendula** L.

About 15 species centred in the Mediterranean region, extending westwards to the mid-Atlantic islands, southwards to the central Saharan Hoggar Mts and in the Arabian Peninsula to Yemen, eastwards as far as Iran.

Calendula arvensis L., Sp. Pl., ed. 2, 1303 (1763).

Vernacular names: ain el baqr, equwan-asfar, hanwa, hanuwa.

Description: Annual herb, up to 20 cm; stems ± erect, pubescent, leafy. Leaves 2–6 × 1–2 cm, lanceolate, base clasping, apex obtuse, margins entire to remotely denticulate. Capitula radiate, solitary at the end of the branches, on stout peduncles. Involucre widely cup-shaped, 8 mm long, phyllaries 2-seriate, linear-lanceolate, acuminate, with scarious margins. Ray flowers pistillate, yellow or orange, ray lamina 7–9 mm long; disc flowers perfect but functionally staminate, yellow, tubular. Achenes polymorphic, strongly tuberculate at the back, the marginal boat-shaped and beaked, to 15 mm long (or more), others boat-shaped to annulate. Pappus absent.

Flowering and fruiting: December to March.

Distribution and habitat: Northern Oman and Musandam, a weed in sandy watercourses, gardens, moist and irrigated places; not common. *Altitude*: 250–1300 m. Originating in the Mediterranean region and widely naturalised in Europe, Asia, Africa and the Americas. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 855.

25. **Tripteris** Less.

About 20 species, preferably in southern Africa, with one species extending to E Africa and the Arabian Peninsula northwards to Sinai and S Jordan.

Tripteris vaillantii Decne., Ann. Sci. Nat., Bot. 2: 260 (1834).
Synonym: *Osteospermum vaillantii* (Decne.) Norl. (1943).

Description: Annual to pauciennial herb to 60 cm, glandular-hairy; stems erect, leafy, branching. Leaves to 50 × 25 mm, lanceolate to oblanceolate, subentire to dentate, base cuneate, semiamplexicaul. Capitula radiate, solitary at the end of the branches, on peduncles to 10 cm long, nodding at maturity. Involucre 5–6 mm long; phyllaries linear-lanceolate, with wide scarious margins, hairy. Flowers yellow, ray flowers pistillate, ray lamina 6–8 mm long; disc flowers functionally male, tubular. Achenes ± 10 mm long, body slender-clavate with echinulate surface and 3 membranous, reddish wings to 4 mm wide. Pappus absent.

Flowering and fruiting: March to June in Northern Oman; September to November in Southern Oman.

Distribution and habitat: Northern Oman, Jebal Akhdar and eastern Hajar mountains, and Southern Oman, Dhofar, amongst rocks and stones. *Altitude*: 400–1500 m. Distributed in E Africa northward to Jebal Elba, on Soqotra, and in the mountains of the Arabian Peninsula northwards extending to Sinai and S Jordan, south-eastwards as far as Dhofar and the Hajar mountains. Elsewhere in the Arabian Peninsula found in Saudi Arabia and Yemen; also found on Soqotra.

Distribution map & Illustration: 856.

Notes: This species has been treated previously under *Osteospermum*. Recent molecular phylogenetic work revealed that *Osteospermum* in its wide circumscription is highly polyphyletic, and that has led to the resurrection of the genus *Tripteris*, formerly included as a subgenus in *Osteospermum*.

The report of this species (under *Osteospermum vaillantii*) for the Musandam (by Jongbloed 2003) is based on a single misidentified photographic record (pers. comm. G. Feulner).

VII. **Tribe Gnaphalieae**

26. **Cymbolaena** Smoljan.

A monotypic genus, distributed in SW and C Asia.

Cymbolaena griffithii (A.Gray) Wagenitz, Oesterr. Bot. Z. 119: 402 (1971).
Basionym: *Stylocline griffithii* A.Gray (1873). *Synonyms*: *Micropus longifolius* Boiss. & Reut. (1875); *Cymbolaena longifolia* (Boiss. & Reut.) Smoljan. (1955).

Description: Tiny, procumbent, ephemeral, annual herb with adpressed, white-woolly indumentum. Leaves to 15 × 3 mm, linear-elliptic to linear-spatulate, acute, mucronate. Capitula disciform, 2.5 mm, pedunculate, aggregated into dense terminal or axillary densely woolly glomerules, 10–20 mm across and surrounded by leaves. Involucre ± 4 mm long; phyllaries densely white-woolly, acute; outer phyllaries minute; the 8–10 median phyllaries in 2 series, with a scarious glabrous appendage, enveloping each a marginal flower; the 5 inner phyllaries surrounding the 4 central flowers, slightly plicate, linear-lanceolate, with a dorsally prominent, yellowish, basally protruding midrib. Flowers purple, marginal pistillate, filiform; central flowers functionally male, tubular. Achenes of marginal flowers 1–1.5 mm long, compressed, glabrous, of central flowers vestigial, sparsely hairy. Pappus in marginal achenes absent, in the vestigial central achenes of a few caducous bristles.

Flowering and fruiting: September, March to April.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal), in small pockets of soil amongst stones; rare. *Altitude*: ± 1400 m. An Irano-Turanian species distributed from Sinai, Jordan to Syria, E Turkey, Armenia, Iraq, Iran, Northern Oman, Afghanistan and Pakistan to C Asia. In the Arabian Peninsula restricted to Musandam in Oman.

Distribution map & Illustration: 857.

Notes: The species has been collected only twice from Musandam, but being a tiny ephemeral it has possibly been overlooked. The species may be mistaken with *Lasiopogon muscoides* and compact forms of *Filago desertorum* but can be distinguished from both by the densely white-tomentose, acute phyllaries (obtuse, rounded and except for the outermost glabrous in *L. muscoides,* outer and middle phyllaries conspicuously long-acuminate in *F. desertorum*). *L. muscoides,* in addition, has plumose instead of scabrid pappus bristles.

27. **Filago** L.

Forty-six annual species, centred in the Mediterranean region and extending to N Europe, the Horn of Africa, SW and C Asia and North America.

Filago is represented in Oman by inconspicuous, easily neglected ephemeral species, which, moreover, seem to be rather rare. Species may strongly resemble each other and the tiny, crowded structures hamper a convenient study of the reliable diagnostic features. Three species may occur in Oman; presence and identity of *F. desertorum* is well established and this is the commonest one, the more mesic *F. pyramidata* seems much rarer, and the presence (and identity) of *F. abyssinica,* which may be confused especially with the latter species, is not surely established yet. To stimulate further collecting, all three species are nevertheless treated here.

1. Innermost phyllaries of the involucre with their lateral margins never ciliate (lense!); plants erect or prostrate 2
   Innermost phyllaries with long-ciliate lateral margins (lense!); plants mostly prostrate, the basally branching stem with at least one (sub)basal cluster of capitula .... 1. **F. desertorum**
2. Involucre approximately 5-angular in its upper part, of a regular series of 5 phyllaries, each radially inside followed by superposed receptacular scales of similar shape and size ..... 2. **F. pyramidata**
   Involucre with phyllaries not in regular peripheral or radial series .... 3.**F. abyssinica**

1. ***Filago desertorum*** Pomel, Bull. Soc. Sci. Phys. Algérie 11: 46 (1874).

Vernacular names: quottainah, gitaina.

Description: Small annual herb, loosely greyish tomentose, with a very short (at most a few cm long), mostly prostrate stem terminated by a globose cluster of capitula and with several, mostly procumbent branches from below the cluster, each terminated again by a dense cluster of capitula and often branched like the main axis. Leaves narrowly spatulate, up to 15 × 4 mm, entire, most of them crowded below the clusters and often exceeding them. Capitula discoid, in glomerate clusters. Involucre 4–5 mm long, phyllaries linear-lanceolate, outer and middle phyllaries with protruding, conspicuously long-acuminate tip, at the margin and in the upper part long-hairy; inner ones acute, long-ciliate, otherwise glabrous, at fruiting spreading and brown to purplish-brown; middle and inner phyllaries enveloping the female flowers. Marginal flowers filiform, pistillate, disk flowers tubular and perfect, all

yellow. Achenes 0.8 mm long, narrowly obovoid, somewhat compressed. Pappus of white caducous bristles 2–2.5 mm long.

Flowering and fruiting: January to April.

Distribution and habitat: Northern Oman, Musandam, Hajar mountains and the Batinah coast, on silty ground in wadis and depressions. *Altitude*: 100–1600 m. Distributed from the Canary Islands across N Africa and from Sinai across the Arabian Peninsula to Iraq, Iran, Caucasus, C Asia, Afghanistan and Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE.

Distribution map & Illustration: 858.

Notes: Compact forms of this species may be mistaken for *Cymbolaena griffithii* and *Lasiopogon muscoides,* but can be distinguised from both by its long-acuminate outer and middle phyllaries (all acute and densely tomentose in *C. griffithii,* all obtuse, rounded in *L. muscoides*). *L. muscoides,* in addition, has plumose instead of scabrid pappus bristles.

2. ***Filago pyramidata*** L., Sp. Pl.: 1199 (1753).

Description: Small erect or, more rarely, procumbent, greyish tomentose annual; stem usually branched, the lowermost cluster of capitula terminating the stem somewhat higher up and overtopped by the branches the stem, each terminated again by a cluster of capitula and usually branched like the main axis. Leaves narrowly spatulate, entire, up to at most 30 × 10 mm, most of them crowded below the clusters and usually exceeding them. Capitula discoid, in glomerate clusters. Involucre 4–5 mm long, approximately 5-angular, of a regular series of 5 phyllaries, each radially inside followed by 3–5 superposed phyllaries of similar shape and size enveloping the marginal flowers; phyllaries linear-lanceolate, outer and middle phyllaries with protruding, conspicuously long-acuminate tips, hairy; inner ones acute, glabrous. Marginal flowers filiform, pistillate, disk flowers tubular and perfect, all yellow. Achenes 0.8 mm long, narrowly obovoid, compressed, somewhat papillose. Pappus of white caducous bristles 2–2.5 mm long.

Flowering and fruiting: January to April.

Distribution and habitat: Northern Oman, Musandam and Hajar mountains, in fields and waste ground. Distributed in W and S Europe to the Crimea and Caucasus, in N Africa, SW and C Asia. Elsewhere in the Arabian Peninsula in Kuwait, Saudi Arabia, the easternmost UAE and Yemen.

Distribution map & Illustration: 859.

3. ***Filago abyssinica*** Sch.Bip. ex A.Rich., Tent. Fl. Abyss. 1: 432 (1847).
Synonyms: *Filago vulgaris* Lam. var. *abyssinica* (A.Rich.) Cufod. (1966).

Description: Small erect greyish tomentose annual up to 10 cm high; stem branched. Leaves usually spatulate, up to 20 × 5 mm, entire, apex obtuse to acute. Capitula discoid, crowded in globose axillary or terminal clusters. Involucre with phyllaries not in regular peripheral

or radial series, phyllaries greenish and turning brownish-purplish, with scarious margins, except for the inner with conspicuously long-acuminate tips, in basal half loosely woolly; middle and inner phyllaries enveloping the female flowers. Marginal flowers filiform, pistillate, disk flowers tubular and perfect, all pale yellow. Achenes less than 1 mm long, narrowly obovoid, somewhat compress. Pappus of white caducous bristles 2–2.5 mm long.

Flowering and fruiting: January to April (?).

Distribution and habitat: Northern Oman, Hajar mountains, amongst rocks. *Altitude*: ± 700 m. Distributed in the mountains of Ethiopia, Eritrea, S Sudan and the southern Arabian Peninsula. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 860.

Notes: A single specimen that, according to the monographer of the genus, G. Wagenitz, may represent this species has been collected in the Hajar mountains (Wadi Salahi between Tuwaybah and Al Amirah, rocky volcanic slopes, 500 m, 9.3.1980, *J.R. Edmondson* 3314, E).

28. **Helichrysum** Mill.

500–600 species, distributed with centres of diversity in southern Africa and on Madagascar, from the mid-Atlantic archipelagos throughout Africa, the Mediterranean area and Europe to C and S Asia.

1. Involucre straw-coloured or yellowish; capitula (sub)sessile and densely congested in glomerate or hemispherical synflorescences 2
   Involucre silvery white, often tinged pink or rose when young; capitula shortly pedunculate, arranged in globose-umbellate synflorescences ..... 1. **H. glumaceum**
2. Cushion forming dwarf shrub; leaves with curry scent; involucre yellowish; flowers bright yellow ..... 3. **H. somalense**
   Annual herb with simple or branched leafy stem; leaves without curry scent; involucre straw-coloured; flowers whitish to pale yellow ..... 2. **H. luteoalbum**

1. ***Helichrysum glumaceum*** DC., Prodr. 6: 197 (1838).

Synonyms: *Achyrocline glumacea* (DC.) Oliv. & Hiern (1877); *A. luzuloides* Vatke (1875); *Helichrysum makranicum* (Rech.f. & Esfand.) Rech.f. (1980).

Vernacular name: shajarat al balbul.

Description: Subshrub to 30 cm high; flowering stems slender, white-tomentose to glabrescent, usually crowded leafy basally, higher up leafless or with distant bracts. Leaves up to 3 × 1 cm, spatulate to elliptic or linear, usually densely white-tomentose, greyish-green. Capitula disciform, at the end of the flowering stems arranged in a globose-umbelliform synflorescence composed of a few globose-umbelliform partial synflorescences each of 10–20 shortly pedunculate capitula. Involucre 3–5 mm long; phyllaries proximally with herbaceous centre, otherwise white-scarious, distally silvery white opaque, in early stages

often tinged pink or rose. Flowers white to yellowish; outer ones filiform, pistillate, inner ones tubular, perfect. Achenes 0.5–1 mm long, densely glandular. Pappus of caducous, white bristles in one row, 2.5–3 mm long.

Flowering and fruiting: January to April in Northern Oman, September to December (?) in Dhofar.

Distribution and habitat: Northern Oman, Musandam and Hajar mountains; Southern Oman, Dhofar on sparsely vegetated rocky slopes and ridges, rock crevices, and stony places. *Altitude*: 200–2000 m. Widespread in the Sudano-Zambesian region in Africa, and extending across the southern Arabian Peninsula to S Iran. Elsewhere in the Arabian Peninsula found in W Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 861.

Notes: The populations of this species in Iran were described as *Helichrysum makranicum*, a name later also used for the populations in Northern Oman. The taxon is, however, not distinct from the widespread *H. glumaceum* and therefore sunk in its synonymy.

2. ***Helichrysum luteoalbum*** (L.) Rchb., Handb. Gewächsk., ed. 2, 2(2): 1460 (1829).
Basionym: *Gnaphalium luteoalbum* L. (1953). *Synonym: Pseudognaphalium luteoalbum* (L.) Hilliard & Burtt (1981)
Vernacular name: sabounat el'afrit.

Description: Erect white-tomentose annual, to 60 cm high, stem leafy, simple or branched, without non-flowering shoots. Leaves spatulate to linear, decreasing in size upwards. Capitula disciform, (sub)sessile, crowded in dense terminal glomerules, these single or by several. Involucre 3–4 mm long; phyllaries scarious, straw-coloured, glossy, glabrous except for the base. Flowers whitish to yellowish, apically tinged purple; outer ones numerous, pistillate, filiform, inner ones few, tubular, perfect. Achenes ± 0.5 mm long, ellipsoidal, minutely papillose. Pappus of white, caducous bristles in one row, ± 2 mm long.

Flowering and fruiting: Throughout the year.

Distribution and habitat: Northern Oman, Musandam and Hajar mountains, Central Oman on Jiddat al Harasis; in Southern Oman, Dhofar. A weed or ruderal in moist places of irrigated plantations and gardens. Distribution cosmopolitan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 862.

3. ***Helichrysum somalense*** Baker, J. Bot. 37: 60 (1899).
Synonyms: *Helichrysum pumilum* (Schinz ex Klatt) Moeser (1910), nom. illeg. [non Hook.f. (1856)]; *Achyrocline pumilum* Schinz ex Klatt (1895).
Vernacular names: izbun, hilben (Jibbali)

Description: Cushion forming dwarf shrub to 40 cm high, branches white-tomentose. Leaves 5–30 × 1–10 mm, spatulate to lanceolate, white-tomentose. Capitula disciform,

sessile, by several crowded at the end of the leafy branches. Involucre 2–3.5 mm long; phyllaries glabrous, proximally with herbaceous centre, otherwise scarious, distally yellowish and more opaque. Flowers bright yellow, the marginal filiform, pistillate, the inner tubular, perfect. Achenes ± 1 mm long, brown, glabrous. Pappus of white bristles in one row, 2–2.5 mm long, caducous as a whole.

Flowering and fruiting: September to December (?).

Distribution and habitat: Southern Oman, Dhofar, on sparsely vegetated rocky slopes and ridges, plateaus and slopes with *Euphorbia balsamifera*. *Altitude*: 450–1400 m. Distributed in the Horn of Africa region (Ethiopia, Somalia) and in the southwestern Arabian Peninsula. Elsewhere in the Arabian Peninsula in S Yemen only.

Distribution map & Illustration: 863.

29. **Ifloga** Cass.
13 species, all but one species restricted to southern Africa, one widespread in the Saharo-Arabian region.

Ifloga spicata (Forssk.) Sch.Bip. in Webb & Berth., Phytogr. Canar. 2: 310 (1845).
Basionym: *Chrysocoma spicata* Forssk. (1775).
Vernacular names: shjarat al m'aza, hasaj, tarabah, zunaymah.

Description: Annual herb to 10 cm, with few, tufted, densely leafy stems of bottle-brush-like appearance. Leaves linear, to 20 × 1 mm, tomentose above and ± glabrous below, becoming ± involute. Capitula disciform, by 1–3 per node crowded in long, leafy racemiform synflorescences. Involucre ± 3 mm long, phyllaries ovate-acute, straw-coloured to reddish-brown, scarious for the most part; the outer boat-shaped, enveloping the filiform, pistillate flowers; the inner persistent, surrounding the tubular, perfect disc flowers. Achenes less than 1 mm long, glandular. Pappus present only in the perfect disc flowers, of ± 10 apically plumose, ± 2 mm long bristles.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam and Hajar mountains, in wadi beds, and on sand and gravel plains. *Altitude*: 400(?) 1300(?) m. Distributed from the Canary Islands and SE Spain across N Africa and SW Asia to Pakistan and NW India. Elsewhere in the Arabian Peninsula found in Kuwait, Saudi Arabia, UAE.

Distribution map & Illustration: 864.

30. **Lasiopogon** Cass.
Eight annual species, with a centre of distribution in southern Africa and extending with one species to SW Asia, N Africa and the SE Iberian Peninsula.

Lasiopogon muscoides (Desf.) DC., Prodr. 6: 246 (1838).
Basionym: *Gnaphalium muscoides* Desf. (1799).

Description: Samll, procumbent, tomentose, ephemeral annual herb, much-branched from the base, with filiform, few cm long, leafy stems. Leaves to 12 × 3 mm, spatulate, rounded, entire. Capitula discoid, in globose clusters surrounded but not exceeded by the leaves at the end of the branches. Involucre 2–3 mm long; phyllaries in 2 rows, linear-lanceolate with obtuse, rounded tip, outermost white-woolly, others ± glabrous. Flowers purple, the outer in several rows, filiform, pistillate, the inner 5–6 tubular, perfect. Achenes ± 0.5 mm long, obovoid, compressed. Pappus ± 1–2 mm long, of a single series of entirely plumose bristles.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal). *Altitude*: ± 1800 m. Distributed in N Africa, the SE Iberian Peninsula and SW Asia eastwards as far as Azerbaijan, Iran, Afghanistan and W Pakistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, probably also present in the easternmost mountainous UAE.

Distribution map & Illustration: 865.

Notes: The presence of the species in the Musandam was first reported by Jongbloed in 2001.

The species may be mistaken with *Cymbolaena griffithii* and compact forms of *Filago desertorum* but can be distinguished from both in particular by its plumose (instead of scabrid) pappus, the obtuse, rounded and except for the outermost glabrous phyllaries (acute and densely tomentose in *C. griffithii*, outer and middle phyllaries conspicuously long-acuminate in *F. desertorum*).

31. **Phagnalon** Cass.

About 40 species, distributed from the mid-Atlantic archipelagos across the Mediterranean, N Africa, northern tropical Africa and SW Asia to the Himalayas.

Phagnalon schweinfurthii Sch.Bip. ex Schweinf., Verh. Zool.-Bot. Ges. Wien 18: 685 (1868).

Synonyms: *Phagnalon viridifolium* Deene. ex Boiss. (1875); *Phagnalon viridifolium* var. *omanense* Qaiser & Lack (1985); *P. androssovii* B. Fedtsch. (1946); *P. schweinfurthii* var. *androssovii* (B. Fedtsch.) Qaiser & Lack (1985).

Description: Shrublet to 30 cm high, branches loosely to densely white-tomentose. Leaves up to 35 × 8 mm, linear-elliptic to spatulate, subentire to remotely denticulate, usually with undulate and revolute margins, upper surface green, subglabrous, lower surface sparsely hairy and green to densely white-tomentose. Capitula disciform, on wiry, densely to sparsely white-tomentose peduncles several cm long. Involucre 6–9 mm long; phyllaries 1–2 mm wide, with a purple inner and basal, and a white-scarious outer and apical margin around the herbaceous, glabrous and green or hairy, pale inner portion; the outer phyllaries ovate to lanceolate, the middle lanceolate to spatulate, the inner linear-lanceolate and acuminate. Flowers yellow and apically often tinged purple, or purple, or flesh coloured, with yellow

styles and stamina; outer pistillate, filiform, central perfect, tubular. Achenes ± 1 mm long, hairy. Pappus of 5–7 scabrous bristles, ± 6–7 mm long.

Flowering and fruiting: February to May.

Distribution and habitat: Northern Oman, Hajar mountains, including Musandam (Ru'us al Jibal) and Jebal Akhdar, in rocky habitats, on slopes, cliffs and in crevices. *Altitude*: 700–3500 m. Distributed from Egypt and Sudan across the Arabian Peninsula, Iran, Afghanistan and Pakistan to Turkmenistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, eastern UAE, Yemen.

Distribution map & Illustration: 866.

Notes: Qaiser & Lack (1985) were the first to establish the conspecifity of *Phagnalon androssovii*, described from Turkmenistan, and of the material from continental Asia formerly identified as *P. nitidum* with *P. schweinfurthii*, described from NE Africa. *P. schweinfurthii* therefore is considered as a species ranging from NE Africa across the Arabian Peninsula to Iran, Turkmenistan, Afghanistan and Pakistan. *P. viridifolium*, described from Northern Oman (Type: Mascat, *Aucher-Eloy* 4774 (holotype, G-BOIS; isotypes: BM, G, K, W) is treated by Qaiser & Lack (1985) as a separate species, distinguished from *P. schweinfurthii* by green lower leaf surfaces (white-tomentose in *P. schweinfurthii*) and purple to flesh coloured flowers (dull yellow in *P. schweinfurthii*). However, the otherwise great general agreement between both taxa is further emphasised by the fact that the difference in flower colour cannot be confirmed: the corollae may well be apically purple also in material of *P. schweinfurthii* from Iran and Oman. This and the largely overlapping distribution of both taxa in the Arabian Peninsula strongly devaluates the colour or indumentum density, respectively, of the lower leaf surface as a feature for separating the taxa. To what extent the nevertheless conspicuous variation within the wider *P. schweinfurthii* in the Arabian Peninsula may justify the recognition of infraspecific entities must be clarified by a more thorough study of the variation in the entire distribution area.

The occurrence of *Phagnalon schweinfurthii* in the Musandam (Ru'us al-Jibal), Oman and UAE, is substantiated by the collection *Mandaville* 7316 (BM) from Jebal al Harim, 2000 m, of 1979, so determined by Qaiser & Lack (1985) but not given in their distribution map, and several further collections made by Gary Feulner since 1997 (see also Jongbloed 2003: 175).

VIII. **Tribe Astereae**

32. **Erigeron** L.

More than 400 species present in the Americas, Europe, Africa and Asia in a preliminary, wide circumscription also including *Conyza*. The latter genus is, according to molecular systematic studies deeply nested within *Erigeron*, however, probably except for the tropical African species, which may have to be separated as *Nidorella*. The present treatment, for pragmatic reasons, treats all species occurring in Oman as belonging to *Erigeron*.

Leaves all ≤ 5 mm wide, linear-elliptic to linear-spatulate, all entire or the basal ones with a few teeth; involucre ± 5 mm long ..... 1.**E. bonariensis**
Leaves up to ± 20 mm wide, obovate to spatulate and tapering into a petiol-like proximal portion up to half as long as the rest, distal portion shallowly crenate to pinnately lobed; involucre ± 3 mm long ..... 2.**E. trilobus**

1. ***Erigeron bonariensis*** L., Sp. Pl.: 863 (1753).
Synonyms: *Conyza bonariensis* (L.) Cronquist (1934); *Erigeron linifolius* Willd. (1803); *Conyza linifolia* (Willd.) Täckh. [non L.]. (1956).
Vernacular names: hashishat el-jebal, tebaq.

Description: Erect annual herb to ± 1 m high, pubescent with long and short, stiff, adpressed-spreading hairs. Stem leaves ± 10–60 × 1–5 mm, linear-elliptic to linear-spatulate, all entire or the basal ones with a few teeth. Capitula miniradiate; in a paniculiform synflorescence. Involucre ± 5 mm long; phyllaries linear-lanceolate, acute, with scarious margins, pubescent. Flowers whitish, the outer pistillate, filiform, with a tiny, deeply 4-fid ray lamina; inner, much fewer ones perfect, tubular. Achenes ± 1–2 mm long, somewhat compressed, with adpressed-antrorse hairs. Pappus of yellowish, ± 3 mm long bristles often intermixed with a few 0.2–0.3 mm long ones.

Flowering and fruiting: In Northern Oman January to May, in Southern Oman September to December, in suitable habitats also in other months.

Distribution and habitat: Scattered across Oman as a weed of cultivation and as a ruderal in moist, disturbed ground. Native to South America but very widely distributed beyond as a weed and ruderal. Elsewhere in the Arabian Peninsula in Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 867.

2. ***Erigeron trilobus*** (Decne.) Boiss., Fl. Orient. 3: 168 (1875).
Basionym: *Conyza triloba* Decne. (1834). *Synonyms*: *Conyza stricta* Willd. (1803) [non *Erigeron strictus* Hook. & Arn. (1836), non *Nidorella stricta* O. Hoffm. (1902)]; *Erigeron pinnatifidus* D. Don (1825) [non Thunb. (1800)]; *Conyza pinnatifida* Roxb. [(1814), nom. nud.] (Oct.–Dec. 1832) [non (Thunb.) Less. (Jul.–Aug. 1832)]; *C. stricta* var. *pinnatifida* (D. Don) Kitamura (1966); *Nidorella triloba* (Decne.) DC. (1836).

Description: Erect, often basally woody annual to pauciennial, to 20–40(–100) cm high, pubescent with short arced hairs and glandular. Leaves up to ± 40 × 20 mm, obovate to spatulate and tapering into a petiol-like proximal portion up to almost half as long as the rest, distally shallowly crenate to pinnately lobed. Capitula miniradiate; in a corymbose synflorescence at the end of the branches. Involucre ± 3 mm long, phyllaries linear-lanceolate, acute, with scarious margins, pubescent and glandular. Flowers pale yellow, the outer pistillate, filiform, with a tiny, 2–4-fid ray lamina; inner, much fewer ones perfect, tubular. Achenes ± 1 mm long, obovoid and somewhat compressed, glandular. Pappus caducous, of

white, ± 1.5–2 mm long bristles often intermixed with a few ± 0.3 mm long ones.

Flowering and fruiting: October to April (?) in Northern Oman; September to October in Southern Oman; in suitable habitats also in other months.

Distribution and habitat: Northern Oman, in the Jebal Akhdar area, and Southern Oman, Dhofar in grassland, rocky sites, also in disturbed areas, often ruderal and as weed of cultivation. *Altitude*: 200–2850 m. Distributed widely in subtropical and tropical regions of Africa and Asia. Elsewhere in the Arabian Peninsula in SW Saudi Arabia and Yemen.

Distribution map & Illustration: 868.

33. **Psiadia** Jacq.

About 60 mainly shrubby species, the vast majority distributed in Madagascar and the Mascarenes, most others in southern and eastern tropical Africa, three species in the southern Arabian Peninsula and on Soqotra; one species in S India and Sri Lanka.

Psiadia punctulata (DC.) Vatke, Oesterr. Bot. Z. 27: 196 (1877).

Basionym: Nidorella punctulata DC. (1836). *Synonym*: *Psiadia arabica* Jaub. & Spach (1852).

Description: Much branched shrub mostly 0.5–1 high, with viscid, minutely glandular twigs. Leaves shortly petiolate, with narrowly elliptic, leathery, green lamina up to 9 × 2.5 cm, becoming sticky vernicose and shiny by touching, with unpleasant scent. Capitula miniradiate, in hemispherical groups at the end of the branches. Involucre ± 5 mm long, with yellowish-green phyllaries in several rows. Flowers yellow, the marginal pistillate and filiform with inconspicuous 2–3-dentate ray lamina; the inner tubular, perfect but functionally male. Achenes (of ray flowers) cylindric, ± 1 mm long, ribbed, pubescent. Pappus 2–3 mm long, of one row of dirty white bristles united at base.

Flowering and fruiting: September to January (?).

Distribution and habitat: Southern Oman, Dhofar, on rocky upper escarpments and rolling plateaus near the coastal edge, in the *Acacia etbaica* and *Euphorbia balsamifera* zones. *Altitude*: (650–)900–1400 m. Widely distributed from southern Africa across east tropical Africa to the Horn of Africa and the Arabian Peninsula. Elsewhere in the Arabian Peninsula found in the mountains of Yemen and SW Saudi Arabia. In Dhofar the species reaches its eastern limit of distribution.

Distribution map & Illustration: 869.

IX. **Tribe Anthemideae**

34. **Anthemis** L.

About 175 species, distributed from N Africa and Europe to E Africa and SW Asia; few species introduced and naturalised in North America, southern Africa, Australia and New Zealand.

Anthemis odontostephana Boiss., Diagn. Pl. Orient., ser. 1, 6: 85 (1846).
Synonyms: *Anthemis gayana* Boiss. (1875); *A. gayana* Boiss. var. *multiramosa* Parsa (1948).
Vernacular name: o'qhowan.

Description: Aromatic annual herb to 25 cm high, adpressed-hairy; stems branching from the base, basally leafy , ± erect, weak. Leaves ovate in outline, 10–20 × 5–10 mm, 1-2-pinnatisect, segments linear, acute, shortly petiolate. Capitula radiate, solitary at the end of the branches, on filiform ± 3–10 cm long peduncles thickened upwards in fruit. Involucre 3–4 mm long; phyllaries 2–3 × 1 mm, oblong, obtuse, with broad membranous margins, deciduous. Receptacle conical, with deciduous, subulate, hyaline paleae 2–3 × 0.5 mm. Ray flowers 5–6, pistillate, fertile, white, ray lamina ± 4–5 mm long; disc flowers perfect, yellow, the tubular corolla ± inflated in fruit. Achenes 2.5–3 mm long, cylindric, ± curved, 10–15-ribbed, tuberculate-muricate. Pappus very inconspicuous, in the ray flower achenes a minute, 10–15-dentate rim, in the disk flower achenes a small, unilateral, oblique, ± lacerate auricle.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, in the western and eastern Hajar mountains, and Musandam (Ru'us al-Jibal), mostly at higher elevations, in pockets of sand and silt, amongst rocks and stones, edges of and in cultivated fields where becoming weedy. *Altitude*: 1000–1850 m. Distributed from Iraq to Pakistan. Elsewhere in the Arabian Peninsula found in the UAE.

Distribution map & Illustration: 870.

Notes: The species touches the Arabian Peninsula from across the Straits of Hormoz only in N Oman and adjacent UAE.

35. **Artemisia** L.
About 540 species (in its wider circumscription including, e.g., *Seriphidium*, which is supported by all recent systematic studies), distributed throughout the northern hemisphere and extending to southern Africa, South America and Pacific islands.

Artemisia sieberi Besser, Bull. Soc. Imp. Nat. Moscou 9: 80 (1836).
Synonyms: *Seriphidium sieberi* (Besser) K.Bremer & Humphries ex Y.R.Ling (1991); *Artemisia herba-alba* Asso var. *laxiflora* Boiss. (1875); *A. herba-alba* auct., non Asso.
Vernacular names: ailamat; shih (Arabic).

Description: Shrublet to ± 40 cm high, greyish-tomentose to glabrescent and strongly aromatic, with many rigid, erect to spreading branches. Basal and lower leaves petiolate, rounded in outline, bipinnatisect, 5–16 × 5–12 mm, with lanceolate, obtuse segments to ± 4 mm long; upper and middle leaves subsessile to sessile, basally auriculate, in the upper floral region palmatisect or linear, entire, subtending floral branches. Capitula discoid, nu-

merous densely sessile in paniculiform synflorescences. Involucre oblong, 6–7-seriate, 3–4 mm long, glabrous except for the base; phyllaries imbricate, outermost herbaceous, inner oblong-oblanceolate, ± glabrous, obtuse, with broadly scarious margins. Flowers 3–4(–5), perfect, tubular, 5-toothed, yellowish to purple. Achenes ± 1 mm long, obovate. Pappus absent.

Flowering and fruiting: April to June.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal), on rocky ridge tops and the summit areas, in pockets of sand and silt, among rocks and stones, also fallow fields. *Altitude*: 1000–2000 m. Distributed from the E Mediterranean across SW Asia to SW Pakistan and C Asia. Elsewhere in the Arabian Peninsula found in Kuwait(?), E Saudi Arabia, Qatar and the UAE (Ru'us al-Jibal).

Distribution map & Illustration: 871.

Notes: This is one of the most common plants found on the summit areas of the Musandam mountains. It is very aromatic especially when leaves and stems are bruised or crushed; its leaves have been used in traditional medicine to make an infusion taken as an anthelmintic.

36. **Matricaria** L.

Six annual species, distributed from the mid-Atlantic archipelagos across Europa, N Africa, W and SW Asia to C Asia and western North America; some species as weeds widespread beyond.

Matricaria aurea (Loefl.) Sch.Bip., Bonplandia 8: 369 (1860).
Basionym: Cotula aurea Loefl. (1758).
Vernacular name: babunaj.

Description: Aromatic, glabrous annual, much branched from the base, to ± 20 cm high. Leaves up to 2.5 × ± 1 cm, finely bipinnatisect, segments only ± 1 mm wide. Capitula discoid, terminal, solitary, on filiform peduncles up to a few cm long. Involucre hemispherical, 2–3 mm long, 4–8 mm in diameter; phyllaries imbricate, with brown, scarious margins. Receptacle strongly conical, disk flowers therefore surmounting the involucre. Flowers many, bright yellow, 4-lobed, tubular. Achenes ± 1 mm long, brown. Pappus a membranous, irregularly lobed corona, to ± 0.5 mm long.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal), on plateaus and in fields, in silt between rocks. Distributed in the southern Mediterranean region and eastwards to the Himalayas. Elsewhere in the Arabian Peninsula in Kuwait, Qatar, Saudi Arabia and UAE (Ru'us al-Jibal).

Distribution map & Illustration: 872.

X. **Tribe Inuleae**

37. **Blumea** DC.

Close to 100 species, distributed mainly in tropical Asia, otherwise in Australia and Africa, a few species are widespread weeds or ruderals.

Flowers yellow, leaves usually distinctly lobed and dentate ..... 1. **B. lacera**
Flowers pink, leaves rather weakly dentate ..... 2. **B. axillaris**

1. ***Blumea lacera*** (Burm.f.) DC. in Wight, Contrib. Bot. Ind.: 14 (1834).
Basionym: Conyza lacera Burm.f. (1768).

Description: Annual (to pauciennial?) herb, glandular and densely covered with silky, whitish hairs; stems simple to branched, erect, up to ± 80 cm high. Leaves obovate to spatulate, to 7 × 3 cm (probably also larger), entire to shallowly pinnately lobed and margin strongly dentate with pungent teeth, attenuate into a narrow base. Capitula disciform, in dense to lax, terminal and axillary, narrow paniculiform synflorescences. Involucre 5–6 mm long, of numerous linear phyllaries, green and the inner series with scarious margins. Flowers yellow, outer ones filiform, pistillate, inner few, tubular, perfect. Achenes cylindric, 0.5–1 mm long. Pappus ± 3 mm long, of ± 6–8, easily detachable white bristles.

Flowering and fruiting: October (?) to December.

Distribution and habitat: Southern Oman, Dhofar, on hillsides, a ruderal species, the most widespread in the genus, being distributed in tropical Africa and Australasia. Elsewhere in the Arabian Peninsula doubtfully reported from N Yemen.

Distribution map & Illustration: 873.

Notes: The species is here for the first time reported from Oman and the Arabian Peninsula and so far known to us only from Ain Tabrook, 17°06'00"N, 54°19'35.1"E, at 110 m altitude, between rocks in the dry part of the wadi bed (4.12.2002, *N. Kilian* 9244, B) and 1 km S of Shir, ± 17°10'N, 54°10'E, 500 m, *Anogeissus* woodland (1.11.2006, *M. Thulin* 11430, ON, UPS). See note under *B. axillaris*.

2. ***Blumea axillaris*** (Lam.) DC., Prodr. 5: 434 (1836).
Basionym: Conyza axillaris Lam. (1786). *Synonym: Blumea mollis* (D. Don) Merrill (1910).

Description: Annual to pauciennial herb, glandular and softly pilose of white, spreading hairs; stems simple, erect to ± 70 cm high. Leaves obovate to spatulate, up to 10 × 6 cm, entire, margin dentate, attenuate into a narrow base. Capitula disciform, in dense to lax terminal and axillary, narrow paniculiform synflorescences. Involucre ± 3–5 mm long, of numerous linear phyllaries, green or purplish. Flowers purple to lilac, outer ones filiform, pistillate, inner few, tubular, perfect. Achenes cylindric, 0.5–1 mm long. Pappus ± 3–4 mm long, of ± 12 white, caducous bristles.

Flowering and fruiting: September to December(?).

Distribution and habitat: Southern Oman, Dhofar, in open disturbed places. Ruderal species widespread in tropical Africa and Asia, also on New Caledonia. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 874.

Notes: Very similar to *Blumea lacera* (with yellow flowers), but leaves usually less incised and dentate and capitula little smaller, difficult to distinguish in herbarium material when flower colour is not visible. For the first time listed for Oman by Ghazanfar (1992 as *B. mollis*) but with doubts regarding the determination. Its presence is confirmed by several collections from Dhofar made by Kilian (1998, *Kilian* 5552, B, ON), Thulin (UPS) and Baird & al. (1999, *Baird & al.* 180, B).

38. **Doellia** Sch.Bip.

Two species, distributed in southern, eastern tropical (also on Madagascar) and northeastern Africa (N Chad (Tibesti Mts), Sudan, Egypt), Sinai, Israel/Palestine and Jordan, in the Arabian Peninsula and in Iran, Afghanistan and Pakistan.

Doellia bovei (DC.) Anderb., Willdenowia 25: 21 (1995).

Basionym: Conyza bovei DC. (1834). *Synonyms*: *Blumea bovei* (DC.) Vatke (1875); *Erigeron bovei* (DC.) Boiss. (1875).

Vernacular name: hasish al-faras.

Description: Perennial, basally woody herb, to ± 40 cm, sparsely pubescent to almost glabrous, branched from the base. Leaves alternate, linear-lanceolate, up to ± 8 × 1 cm, dentate, shallowly sinuate-dentate to almost entire, base weakly auriculate. Involucre 5–6 mm long, 3–4 mm in diameter, of numerous linear-lanceolate, acute to acuminate phyllaries. Capitula disciform, single or in lax axillary or terminal corymbiform synflorescences. Flowers purple to lilac, marginal flowers female, filiform, in several rows, inner flowers perfect, tubular. Achenes almost 1 mm long, columnar-cylindric, brown, with conspicuous, red, longitudinal resin ducts, pubescent. Pappus ± 3–4 mm long, of a few barbellate setae.

Flowering and fruiting: Almost all around the year in sites with water supply.

Distribution and habitat: Northern Oman, widespread in the Hajar mountains and the foothills; Southern Oman, Dhofar, in the foothills; very scattered, in open, dry habitats mainly by water such as near springs, seasonal streams, water holes, pools, dripping cliffs, irrigation channels (aflaj), has some salt tolerance. *Altitude*: 400–1200(?) m. Distributed from E Africa to Sinai, Israel Palestine and Jordan, and across the Arabian Peninsula to Iran, Afghanistan and Pakistan. Elsewhere in the Arabian Peninsula in Saudi Arabia, easternmost UAE and Yemen.

Distribution map & Illustration: 875.

39. **Iphiona** Cass.

Twelve species, centred in the southern Arabian Peninsula (6 species), extending in the South to N Somalia (2 species), in the West on both sides of the Red Sea as far as Sinai, S Israel and S Jordan (3 species) and in the East to S Iran, S Afghanistan and W Pakistan (3 species).

1. Leaves stiff and pungent; ray flowers always absent 2
   Leaves soft, somewhat succulent and never pungent; ray flowers usually present ... 3
2. Lowers leaves and branches with ± 1 mm long, white, stiff, flat bristly hairs .... 2. **I. horrida**
   Leaves and branches glabrous to glandular-hairy but never with bristly hairs as above ..... 3. **I. scabra**
3. Leaves cuneate to spatulate, completely entire or entire except for the dentate to lobulate apex ..... 2. **I. aucheri**
   Leaves spatulate to elliptic in outline, dentate to pinnatifid ..... 4. **I. senecioides**

1. ***Iphiona aucheri*** (Boiss.) Anderb. in Léonard, Contr. Étude Fl. Vég. Déserts d'Iran 4: 37 (1984).

Basionym: *Grantia aucheri* Boiss. (1846). *Synonyms*: *G. discoidea* Bunge ex Boiss. (1875); *G. flabellata* S. Moore (1900).

Description: Perennial herb to ± 1 m high; branches herbaceous, spreading-erect, hollow, leafy. Leaves up to 6 × 3 cm, cuneate to spatulate, apically truncate and entire to dentate, fleshy, sparsely glandular or arachnoid. Capitula radiate, single or in a loosely corymbiform synflorescence at the end of the branches. Involucre 14–18 mm long; phyllaries linear to lanceolate, in one row, frequently surrounded by similarly shaped leaves little longer than the involucre. Flowers bright yellow; ray flowers sterile, ray lamina 4–8 mm long; disc flowers perfect. Achenes 3–4 mm long, ellipsoidal, ribbed and hairy, with a short glandular apical neck. Pappus whitish, with an inner row of 5–15 bristles ± 10 mm long and an outer row of narrowly triangular scales up to ± 0.5 mm long.

Flowering and fruiting: January to May.

Distribution and habitat: Northern Oman, Musandam, and the lower altitudes of the Hajar mountains, on slopes, wadi banks, sandy places and rocky deserts. *Altitude*: 50–600 m. Distributed in the south-easternmost part of the Arabian Peninsula and in S Iran to SW Pakistan. Elsewhere in the Arabian Peninsula found in the eastern UAE.

Distribution map & Illustration: 876.

Notes: The plants are recorded to be poisonous for the lifestock (Jongbloed 2003).

2. ***Iphiona horrida*** Boiss., Diagn. Pl. Orient., ser. 1, 6: 80 (1846).

Type: Oman: ad radices montium Mascatensis, *Aucher-Eloy* 4725 (holotype, G-BOIS; isotypes, G, K, MO).

Description: Pleasantly aromatic shrublet, much branched, to ± 30 cm high; branches and lower leaves usually with ± 1 mm long, flat, white, stiff bristly hairs. Leaves up to 5 × 0.2 cm, subulate, terete to almost triquetrous, stiff, pungent, persistent, basally with pungent subulate lobes. Capitula discoid, single or in a loose corymbiform synflorescence at the end of branches. Involucre ± 10 mm long, phyllaries linear-lanceolate, with mucronate apex, in several rows. Flowers yellow, all tubular and perfect. Achenes ellipsoidal to obconical, ribbed and hairy, 2–3 mm long. Pappus ± 5 mm long, of numerous brownish bristles in several series, the inner successively longer than the outer.

Flowering and fruiting: February to April.

Distribution and habitat: Northern Oman, Jebal Akhdar area, in wadis, and stony slopes. *Altitude*: 200–500 m. Not known from elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 877.

Notes: The species is endemic to the Jebal Akhdar area. It has frequently been confused with the widespread, following one.

3. ***Iphiona scabra*** DC. ex Decne., Ann. Sci. Nat., Bot., ser. 2, 2: 263 (1834).
Type: Oman: in monte Mascatensi Chebek, *Aucher-Eloy* 4726 (holotype, G-BOIS; isotypes, BM, FI, G, K, P).
Synonym: *Iphiona scabra* var. *pinnatifida* Boiss. (1846).

Description: Subshrub to 60 cm high, strongly branched, glandular or glabrous. Leaves up to 5 × 0.7 cm, linear and subulate to narrowly lanceolate, spatulate or elliptic and pungent, flat to canaliculate or folded along the midrib, entire or dentate to pinnatifid. Capitula discoid, single or by 3–10 in a loosely corymbiform synflorescence at the end of the branches. Involucre 8–12 mm long; phyllaries linear-lanceolate with mucronate apex to acuminate, in several rows. Flowers yellow, all tubular and perfect. Achenes ellipsoidal to obconical, ribbed and hairy, 2–3 mm long. Pappus 5–6 mm long, of numerous brownish bristles in serveral series, the inner successively longer than the outer.

Flowering and fruiting: September to April.

Distribution and habitat: Scattered throughout Oman, on stony, rocky or sandy desert areas, wadi banks, dry mountain slopes, etc. *Altitude*: 50–700 m. Distributed in the southern Arabian Peninsula and along the African and Arabian coast of the Red Sea northwards to Sinai. Elsewhere in the Arabian Peninsula found in Saudi Arabia, eastern UAE, Yemen.

Distribution map & Illustration: 878.

Notes: The species has been confused in Oman with the localised preceding one.

4. ***Iphiona senecionoides*** (Baker) Anderb., Nordic J. Bot. 5: 177 (1985).
Basionym: *Grantia senecionoides* Baker (1895).

Description: Subshrub to ± 1 m high, moderately branched, glandular-hairy. Leaves up to 5 × 2.5 cm, narrowly elliptic to spatulate in outline, coarsely dentate to pinnatifid or bipin-

natifid with acute to obtuse segments, fleshy. Capitula radiate, single or in a loosely corymbiform synflorescence at the end of the branches. Involucre 8–10 mm long; phyllaries linear-lanceolate, acute, adpressed-hairy, in several rows. Flowers bright yellow, ray flowers sterile, ray lamina 4–5 mm long, disc flowers tubular, perfect. Achenes ellipsoidal, ± 2 mm long, ribbed, basally and apically hairy. Pappus whitish, with an inner row of 15–30 similar, barbellate bristles 6–7 mm long and an outer row of narrow scales up ± 1.5 mm long.

Flowering and fruiting: September to May.

Distribution and habitat: Southern Oman, Dhofar, on dry rocky slopes, in wadi beds and coastal areas. *Altitude*: 20–700 m. Distributed in the southern Arabian Peninsula. Elsewhere in the Arabian Peninsula found in Yemen (S).

Distribution map & Illustration: 879.

Notes: Endemic to the southern Arabian Peninsula from SW Yemen to Dhofar.

40. **Pallenis** (Cass.) Cass.

Six species, annuals to perennials, centred in the Mediterranean region and extending to easterly adjacent regions.

Pallenis hierichuntica (Michon) Greuter, Fl. Medit. 7: 47 (1997).

Basionym: Saulcya hierichuntica Michon (1852). *Synonyms*: *Asteriscus hierichunticus* ["*hierochunticus*"] (Michon) Wiklund (1985); *A. pygmaeus* (DC.) Coss. & Durieu (1853); *Odontospermum pygmaeum* (DC.) O.Hoffm. (1890).

Description: Annual herb, shortly villose to scabrid, glabrescent, acaulescent to shortly caulescent and few-branched, procumbent, only a few cm high. Leaves spatulate, up to 10 × 1 cm. Capitula radiate, one to several, sessile to shortly pedunculate in the forks of branches. Involucre broadly campanulate to broadly cyathiform, up to ± 15–20 mm in diameter; phyllaries in an outer series, leaf-like, up to ± 3 cm long, and an inner series, bract-like, lanceolate, up to ± 5 mm long, indurate in fruit and closing over the achenes, opening when moistened. Flowers pale yellow; ray flowers 10–20, ray lamina 3–6 × 1.5–2.5 mm; disk flowers 40–200. Achenes 1–2 mm long, turbinate, densely hairy, triquetrous in ray flowers and 4-angular to subterete in disk flowers. Pappus crown-like, of 6–10 scales ± 1–1.5 mm long.

Flowering and fruiting: January to April.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal) and the Hajar mountains, on silty floors of plateaus, depressions and wadis. *Altitude*: up to ± 1500 m. From the the eastern Canary Islands (Fuerteventura) across N Africa to Egypt and from Sinai eastwards to Syria, Iraq, S Iran and SW Pakistan. Elsewhere in the Arabian Peninsula found in Kuwait, eastern Saudi Arabia, UAE.

Distribution map & Illustration: 880.

41. **Pegolettia** Cass.

Nine species, restricted in distribution with all but one species in southern Africa, one species extending into the drier parts of tropical and subtropical Africa, to the Arabian Peninsula and the Indian Subcontinent.

Pegolettia senegalensis Cass. in Cuvier, Dict. Sci. Nat. 38: 232(1825).
Synonyms: *Kuhnia arabica* DC. (1838).

Description: Annual herb to ± 60 cm tall, much branched especially in uppermost part, glandular and scabridulous. Leaves up to 40 × 3 mm, linear to spatulate, attenuate towards base and with obtuse, mucronulate tip, margin entire or very sparsely dentate. Capitula discoid, with 15–30 flowers; in very loose corymbiform synflorescences on long peduncles. Involucre 7–9 mm long, ± 5 mm in diameter; phyllaries lanceolate, acute, green. Flowers yellow, all perfect and tubular, zygomorphic with 4 minute lobes and one much larger, ± 1.5 mm long lobe. Achenes cylindric, 3.5–4.5 mm long, hairy. Pappus of 5–6 mm long plumose bristles and an outer row of 2 mm long scales.

Flowering and fruiting: October to February (?).

Distribution and habitat: Northern Oman, Hajar mountains, and Southern Oman, Dhofar, montane shrubland on rocky, stony ground. *Altitude*: ± 1000–1800 m. Distributed in a scattered way in the Sudano-Zambesian region in Africa and in the Arabian Peninsula and extending to Pakistan and India. Elsewhere in the Arabian Peninsula found in Saudi Arabia and Yemen.

Distribution map & Illustration: 881.

42. **Pentanema** Cass.

Twenty species in its current, doubtfully monophyletic circumscription, with a distribution centred in eastern SW and C Asia, one species in E Africa (Somalia) and a few annual, weedy species extending beyond to E Africa, S and S E Asia.

Pentanema divaricatum Cass., Bull. Sci. Soc. Philom. Paris 1818: 75 (1818).
Synonyms: *Inula divaricata* (Cass.) Boiss. (1875) [non Nutt. (1818)]; *Vicoa pentanema* Aitch. & Hemsl. (1888) [non *V. divaricata* Benth. (1873)].
Vernacular name: 'ufaynah.

Description: Delicate, usually much branched, annual herb to ± 30 cm, pilose in all parts, with ascending to erect, purplish-brown, leafy stems. Leaves up to 3(–5) × 1(–1.5) cm, spatulate to lanceolate or ovate, obtuse to acute, upper leaves broadly rounded to clasping at base. Capitula radiate, single at the end of the branches on wiry, mostly 5–15 mm long, purplish-brown peduncles. Involucre 4–6 mm long; phyllaries herbaceous, linear-lanceolate, acute. Flowers yellow, ray flowers many, pistillate, ray lamina ± 2 mm long, disk flowers tubular, perfect. Achenes almost 1 mm long, antrorsely hairy. Pappus of 5 bristles, ± 4 mm long.

Flowering and fruiting: January to May.

Distribution and habitat: Northern Oman, Musandam, Ru'us al-Jibal, among rocks on silt, abandoned fields and roadsides, locally common. *Altitude*: 0–1300 m. Distributed from N Syria and Iraq through the eastern Arabian Peninsula, Iran, Afghanistan and Pakistan to C Asia and the Himalayas. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, eastern Saudi Arabia and the UAE.

Distribution map & Illustration: 882.

43. **Pluchea** Cass.

Forty five species in a narrow or up to ± 80 species in a wider circumscription, distributed worldwide in tropical and subtropical regions; 7 species are known from the Arabian Peninsula and Soqotra.

1. Leaves auriculate and sometimes also decurrent 2
   Leaves neither auriculate nor decurrent ..... 1. **P. arabica**
2. Leaves broadly auriculate and usually also decurrent; plant densely greyish woolly .. .. 3. **P. ovalis**
   Leaves slightly auriculate but never decurrent; plant pilose ..... 2. **P. dioscoridis**

1. ***Pluchea arabica*** (Boiss.) Qaiser & Lack, Willdenowia 15: 451 (1986).

Type: [Oman], Mascate, *Aucher-Eloy* 4729 (holotype, G-BOIS; isotypes, BM 21190, K).

Basionym: *Varthemia arabica* Boiss. (1846). *Synonyms*: *Phagnalon arabicum* (Boiss.) Boiss. (1875); *Pluchea laxa* Baker (1895); *P. multiflora* O. Schwartz (1939).

Vernacular names: godot (Jibbali); awteeb (Harsusi).

Description: Subshrub to ± 1 m high, strongly aromatic; branches erect, densely glandular, viscid, sometimes pilose, densely leafy and leaves little reduced also in the upper portion. Leaves up to 5 × 2.5 cm, lanceolate, acute, attenuate towards base and sessile, entire, or dentate to pinnatifid, sparsely hairy or rarely pilose. Capitula disciform, with 1–5 cm long, densely glandular peduncles in loosely corymbiform synflorescenes at the end of the branches. Involucre ± 7–9 mm long. Flowers pink, marginal pistillate, filiform, 3(–4)-lobed, disk flowers perfect, tubular, 5-lobed. Achenes ± 1 mm long, ± cylindric, hairy. Pappus 4–6 mm long, of 7–12 barbellate bristles, those of the disk flowers distally plumose.

Flowering and fruiting: Almost throughout the year.

Distribution and habitat: Throughout Oman, mainly in and along wadis, indicating close groundwater level. *Altitude*: 0–750 m. Distributed across the southeastern Arabian Peninsula, elsewhere in the Arabian Peninsula found in SE Yemen.

Distribution map & Illustration: 883.

Notes: The species is endemic to southern Arabian Peninsula. Traditionally the plant has been used medicinally to treat painful swellings and boils; young twigs have also been rubbed over the body as a deodorant.

2. ***Pluchea dioscoridis*** (L.) DC., Prodr. 5: 450 (1836).
Basionym: Baccharis dioscoridis L. (1755). *Synonym*: *Conyza dioscoridis* (L.) Desf. (1815).
Vernacular names: sahikee, barnouf.

Description: Shrub to 3 m high, branches erect, pilose, glandular, rarely glabrous. Leaves up to 7 × 3 cm, lanceolate, dentate or entire, acute, with attenuate auriculate base. Capitula disciform, sessile or on peduncles up to 1.5 cm long in a dense corymbiform synflorescence at the end of the branches. Involucre 4–7 mm long. Flowers pink, marginal pistillate, filiform, 3(–4)-lobed, disk flowers perfect, tubular, 5-lobed. Achenes ± 1 mm long, ± cylindric, hairy, those of the disk flowers often vestigial. Pappus 4–6 mm long, of 10–25 barbellate bristles, those of the disk flowers often distally plumose, caducous.

Flowering and fruiting: October to April.

Distribution and habitat: Of scattered occurrence across Oman, in and along wadis, irrigation channals (falajs), edges of irrigated fields and gardens. *Altitude*: 0–200 m. Widely distributed in tropical and subtropical Africa and the Arabian Peninsula. Elsewhere in the Arabian Peninsula in Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 884.

Notes: Sometimes distinction between this and the following species may be difficult and the differences appear less clear-cut than in the key. Doubts may even be justified whether both are actually specifically distinct.

3. ***Pluchea ovalis*** (Pers.) DC., Prodr. 5: 450 (1836).
Basionym: Baccharis ovalis Pers. (1807). *Synonym*: *Pluchea mollis* Baker (1895).

Description: Shrub to 2 m high, branches erect, pilose, tomentose or greyish woolly and densely covered with sessile or stipitate glands. Leaves up to 7(–11) × 4(–6) cm, ovate, lanceolate or spatulate, acute or obtuse, sessile, auriculate and decurrent, pilose, tomentose or woolly. Capitula disciform, sessile or with peduncles up to 1 cm long, in a dense corymbiform synflorescence at the end of the branches. Involucre 4–7 mm long. Flowers pink to purple, marginal pistillate, filiform, 3(–4)-lobed, disk flowers perfect, tubular, 5-lobed. Achenes ± 1 mm long, ± cylindric, hairy, those of the disk flowers often vestigial. Pappus 4–6 mm long, of 10–20 barbellate bristles, caducous, those of the disk flowers often broadened at base.

Flowering and fruiting: Almost throughout the year.

Distribution and habitat: Of scattered occurrence across Oman, in and along wadis, also along irrigation channels. *Altitude*: 0–500(?) m. Distributed from NW Africa across subtropical and tropical Africa and the southern Arabian Peninsula to the Indian Subcontinent. Elsewhere in the Arabian Peninsula found in Bahrain, eastern Saudi Arabia, UAE.

Distribution map & Illustration: 885.

Notes: See note under the preceding species.

44. **Pseudoconyza** Cuatrec.
One species, distributed in Africa, Asia and Central America.

Pseudoconyza viscosa (Mill.) D'Arcy, Phytologia 25(5): 281 (1973).
Basionym: Conyza viscosa Mill. (1768). *Synonyms*: *Blumea viscosa* (Mill.) Badillo (1974); *B. aurita* (L.f.) DC. (1834); *Laggera aurita* (L.f.) Sch.Bip. ex C.B.Clarke (1876).

Description: Aromatic, densely pilose and glandular, basally woody herb up to 100 cm high. Leaves obovate to oblong, coarsely dentate to subpinnatifid, sessile, base auriculate, in the lower portion of the stem often somewhat interuptedly decurrent. Capitula disciform. Involucre 8–9 mm long. Flowers lilac; outer flowers female, filiform, in several rows, inner flowers perfect, few. Achenes columnar-cylindric, dark brownish, sparsely pilose of adpressed-ascending hairs, with somewhat prominent ribs. Pappus of ± a dozen barbellate bristles.

Flowering and fruiting: September to March.

Distribution and habitat: Of scattered occurrence across Oman, in moist places, by streams and irrigation ditches. Distributed in (sub)tropical Africa, Asia and Central America. Elsewhere in the Arabian Peninsula found in Saudi Arabia and Yemen.

Distribution map & Illustration: 886.

45. **Pulicaria** Gaertn.
About 75 species, distributed from the mid-Atlantic archipelagos across Europe and Africa (except the wet tropical parts), SW and C Asia to India and China. The highest species diversity is found in the region comprising the Horn of Africa, Soqotra archipelago and southern Arabia, with almost 50 species; 11 species are recorded from Oman.

1. Plants subscapose and greyish-tomentose, or prostrate, mat-forming and densely pilose 2
   Shrubs and subshrubs or ± green herbs with well-developed, leafy, usually branched, erect flowering stems 3
2. Subscapose, greyish-tomentose, rosette herb; leaves up to 4.5 cm long, acute ..... 9. **P. semhanensis**
   Delicate, prostrate, densely pilose, mat-forming perennial; leaves less than 1 cm long ..... 8. **P. pulvinata**
3. Inner herbaceous phyllaries with conspicuous straw-coloured and shiny distal portion ..... 5. **P. jaubertii**
   Inner phyllaries herbaceous or coriaceous, without such differentiated distal portion .. 4
4. Leaves regularly with finely and densely undulate margin; corona and filiform bristles of the pappus basally connate and falling together ..... 11. **P. undulata**
   Leaves with usually flat or rarely coarsely and irregularly undulate margin; corona and scabrid or flat bristles of the pappus not basally connate 5

5. Young branches densely white- or greyish-tomentose 6
Young branches ± green 9
6. Leaves narrowly lanceolate to narrowly spatulate, the median ones at most 6 mm wide 7
Leaves obovate to spatulate, up to 4 cm wide 8
7. Involucre 4–5 mm long and 8–9 mm wide; all phyllaries white-tomentose; ray flowers present; Southern Oman only ..... 6. **P. nobilis**
Involucre ± 8 mm long, 4.5 mm wide; inner phyllaries not ± glabrous; ray flowers absent; Northern Oman only ..... 3. **P. edmondsonii**
8. Leaves all white- to greyish-tomentose, at most 4 × 1.5 cm; ray flowers with lamina 3–4 mm long ..... 2. **P. argyrophylla**
Leaves green, up to 10 × 4 mm; ray flowers with ray lamina 6–10 mm long ..... 10. **P. schimperi**
9. Annual to pauciennial herb; leaves spatulate, obtuse to rounded; pappus bristles filiform ..... 1. **P. arabica**
Shrublet or subshrub; leaves linear or linear to spatulate or lanceolate, acute; pappus bristles flat, almost ribbon-like 10
10. Leaves all linear and 1.2 mm wide, involute, glabrous to sparsely hairy, densely glandular and vernicose ..... 4. **P. glutinosa**
Leaves (2–)3–7 mm wide, very rarely linear, usually spatulate or lanceolate and laxely or densely pilose and glandular but not vernicose ..... 7. **P. omanensis**

1. ***Pulicaria arabica*** (L.) Cass. in Cuvier, Dict. Sci. Nat. 44: 94 (1826), s.l.
Basionym: *Inula arabica* L. (1753). *Synonyms*: *Tubilium angustifolium* Cass., nom. illeg. (1828); *Pulicaria inuloides* (Poir.) DC. (1836) [non Vahl ex Hornem. (1815)]; *P. longifolia* Boiss. (1856); *P. arabica* subsp. *inuloides* (Poir.) Maire (1934).
Vernacular names: Iqat, abu 'ain safra.

Description: Aromatic annual to pauciennial herb, to 70 cm high, glandular and with long hairs, usually with several, erect, leafy and already basally branched stems. Stem leaves up to 90 × 12 mm, spatulate, obtuse to rounded, entire to denticulate, base semiamplexicaul. Capitula radiate, at the end of the stems in a loosely corymbiform synflorescence, rarely single. Involucre 5–6 mm long, cup-shaped to hemispherical, 6–12 mm in diameter, with spreading hairs and glandular; phyllaries many, very narrowly linear, outer ones herbaceous, inner ones with scarious margin. Flowers yellow; ray flowers pistillate, ray lamina 1–2 mm long, disk flowers perfect, tubular. Achenes ± 1 mm long, fusiform, somewhat hairy. Pappus of a corona 0.2–0.3 mm long and 8–12 bristles 2.5–3 mm long.

Flowering and fruiting: September to April(?).

Distribution and habitat: Northern Oman, Hajar mountains and Southern Oman, Dhofar; in and along wadis and irrigation channels, near water. *Altitude*: 200(?)–1870 m. Distributed from Morocco across N Africa (and extending to the southern Saharan mountain ranges

and the Horn of Africa), the SE Mediterranean and the Arabian Peninsula to Iraq, Iran and Afghanistan. Elsewhere in the Arabian Peninsula found in Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 887.

Notes: *Pulicaria arabica* has been distinguished by Gamal-Eldin (1981) from *P. inuloides* because of its life cycle, mostly divaricate branching, mostly straw-coloured stems, silky indumentum of non-tubercle-based hairs and mostly shorter leaves. *P. inuloides* however flowers in the first year, and we fail to see clear distinguishing characters between the two taxa. Gamal-Eldin admitted that in many cases it is difficult to place a plant in either taxa. Therefore *P. arabica* is here accepted in a wider sense, including *P. inuloides*, which may be distinguished at subspecies level as *P. arabica* subsp. *inuloides* (Poir.) Maire, if appropriate. The photo in Collenette (Wildflowers of Saudi Arabia, 1999: 211) of *P. inuloides* is misidentified and is actually that of *P. schimperi*. The name *Pulicaria inuloides* (Poir.) DC. is illegitimate because of the existence of an older homonym that is a synonym of *P. vulgaris* Gaertn. and would have to be replaced by *P. longifolia* Boiss.

2. ***Pulicaria argyrophylla*** Franch.
subsp. ***oligophylla*** (E.Gamal-Eldin) N.Kilian & P.Hein, Willdenowia 29: 193 (1999).
Synonyms: *Pulicaria argyrophylla* var. *oligophylla* E.Gamal-Eldin (1981).

Description: Cushion forming shrublet to ± 30 cm tall, densely glandular and with a dense, ash-grey tomentose indumentum. Leaves 1–4 × 0.5–1.5 cm, spatulate to obovate and obtuse to almost cuneate, in upper half coarsely dentate to lobate, attenuate into a petiol-like base as long as or longer than the rest of the lamina. Capitula radiate, single at the end of the branches. Involucre ± 5 mm long, 10–15 mm in diameter, hemispherical; phyllaries tomentose, acuminate. Flowers bright yellow; ray flowers pistillate, ray lamina 3–4 mm long, disk flowers perfect, tubular. Achenes ± 1.5 mm long, hairy. Pappus of a corona 0.5–0.6 mm long and 15–20 flat bristles 3–4 mm long.

Flowering and fruiting: Throughout most of the year.

Distribution and habitat: Southern Oman, Dhofar, in open, stony or rocky habitats. *Altitude*: 50–1350 m. Elsewhere in the Arabian Peninsula distributed in SE Yemen.

Distribution map & Illustration: 888.

Notes: The species is distributed in N Somalia and S Arabia; subsp. *oligophylla* is endemic to Hadhramout, Al-Mahra and Dhofar, the typical subspecies has a disjunct distribution in N Somalia and Hadhramout, Yemen.

3. ***Pulicaria edmondsonii*** E.Gamal-Eldin, Notes R.B.G. Edinb. 41: 467 (1984).
Type: Oman, W Hajar Mts, wadi running into Wadi Fida, N of Jebal Wabah, limestone slopes and flats, 430 m, 12.3.1980, *J. R. Edmondson* 3362 (holotype, E; isotype, ON).
Vernacular name: gesgas.

Description: Subshrub up to 70 cm, intricately branched, all younger branches densely

white-tomentose, glabrescent. Leaves up to 4 cm long, narrrowly lanceolate to narrowly spatulate, the median ones 4–6 mm wide, acute, attenuate into a petiole-like base, white-tomentose, folded along midrib to involute, glabrescent with age. Capitula discoid, single or more frequently by (2–)3 at the end of the branches. Involucre ± 8 mm long, 4–5 mm in diameter; phyllaries pale, straw-coloured, only the outer thinly tomentose. Flowers yellow; all flowers perfect, tubular. Achenes pale brown, ± 2 mm long, cylindric. Pappus of a corona 0.5 mm long and 17–20 flat bristles 4–5 mm long.

Flowering and fruiting: February to June.

Distribution and habitat: Northern Oman, Musandam (Ru'us al-Jibal) and western Hajar mountains, in the foothills and wadi beds, gravelly ground, open rocky slopes. *Altitude*: ± 200–1200 m. Elsewhere in the Arabian Peninsula found in the UAE.

Distribution map & Illustration: 889.

Notes: The species is endemic to Northern Oman and eastern UAE.

4. ***Pulicaria glutinosa*** (Boiss.) Jaub. & Spach, Ill. Pl. Orient. 4: 77. t. 348 (1852).
subsp. ***glutinosa***

Type: [Oman], Muscat, ad rad. mont., *Aucher-Eloy* 4728 (holotype, G-BOIS).
Basionym: *Pterochaeta glutinosa* Boiss. (1846). *Synonym*: *Pulicaria cylindrica* (Baker) O.Schwartz (1939).
Vernacular names: muthadi, thal, fal, muhayda, mithidi, talsayf (Harsusi).

Description: Shrublet up to ± 1 m, branched from base, with greyish older and sticky young branches. Leaves 0.5–5 × 0.1–0.2 cm, linear, entire, involute, acute, glabrous to sparsely hairy, vernicose. Capitula radiate, at the end of the branches in loose corymbiform synflorescences. Involucre 5–7 mm long, campanulate, ± 10 mm in diameter; phyllaries ± linear, leathery, sparsely glandular. Flowers pale yellow; ray flowers pistillate, ray lamina ± 2 mm long, disk flowers perfect, tubular. Achenes 1.5–2 mm long, cylindric. Pappus of a corona 0.1–0.3 mm long and 15–20 flat bristles 4–5 mm long.

Flowering and fruiting: September to May.

Distribution and habitat: Throughout Oman, in the desert and predesert zone, gravelly stony plains, mountains slopes and foothills, wadi banks; frequent. *Altitude*: 0–2000 m. Two subspecies are distinguished, the typical subspecies is endemic to the southern Arabian Peninsula and distributed from SE Yemen eastwards to N Oman and UAE; subsp. *somalensis* E.Gamal-Eldin is restricted to N Somalia.

Distribution map & Illustration: 890.

5. ***Pulicaria jaubertii*** E.Gamal-Eldin, Phanerogam. Monogr. 14: 143 (1981).
Type: [Oman], secus rivulos regn. Muscat, *Aucher-Eloy* 4739 (syntype, P).
Synonym: *Pulicaria orientalis* Jaub. & Spach (1852), nom. illeg., p.p.
Vernacular names: khokhaoot, khokhawoat (Harsusi).

Description: Strongly aromatic perennial herb up to 50 cm high. Stems erect, branched mostly from base, hairy and glandular, greyish-green. Stem leaves up to 4 × 1.5 cm, linear to lanceolate or spatulate, entire or with few teeth, obtuse, strongly hairy and glandular on both surfaces. Capitula radiate, single at the end of the branches. Involucre 6–8 mm long, hemispherical, ± 15 mm in diameter; outer and middle phyllaries entirely herbaceous to scarious at the margins, inner ones with straw-coloured, shiny distal portion. Flowers yellow; ray flowers pistillate, ray lamina 2–3 mm long, disk flowers perfect, tubular. Achenes 1.5–2 mm long, angular, basally attenuate. Pappus of a corona 0.1–0.3 mm long and ± 15 bristles, ± 4 mm long.

Flowering and fruiting: January to May.

Distribution and habitat: Northern and Central Oman, stony-rocky slopes, hillsides, wadi banks, in cultivations. *Altitude*: ± 500–2000(?). Distributed in N Somalia, Eritrea and the Arabian Peninsula. Elsewhere in the Arabian Peninsula found in Qatar, Saudi Arabia, Yemen.

Distribution map & Illustration: 891.

6. ***Pulicaria nobilis*** E.Gamal-Eldin, Phanerogam. Monogr. 14: 227 (1981).
Type: [Oman], Dhofar, Jebal Qara, rocky places in predesert zone, 3.10.1943, *V. Fitzgerald* 12428/13 (holotype, BM).

Description: Cushion forming, white-tomentose subshrub, with erect flowering stems, ± 0.5 m high. Leaves to < 2.5 × 0.2–0.3 cm, narrowly lanceolate with entire obtuse tip, on both surfaces white-tomentose, glabrescent with age. Capitula radiate, single at the end of the stems or on short branches. Involucre 4–5 mm long, hemispherical, 8–9 mm in diameter, phyllaries all densely tomentose. Flowers yellow; ray flowers pistillate, ray lamina 1.5–2 mm long, disk flowers perfect, tubular. Achenes narrowly cylindric, ± 1 mm long. Pappus of a corona 0.2 mm long and 10–12 flat bristles, ± 3–4 mm long.

Flowering and fruiting: September (?) to December (?).

Distribution and habitat: Southern Oman, Dhofar, on dry, open, rocky or gravelly slopes. *Altitude*: 50–800 m. Distributed in the coastal mountains of central south Arabian Peninsula. Elsewhere in the Arabian Peninsula only known from the adjacent Al-Mahra in Yemen.

Distribution map & Illustration: 892.

7. ***Pulicaria omanensis*** E.Gamal-Eldin, Phanerogam. Monogr. 14: 230 (1981).
Type: Oman, Dhofar, Ayun cross roads, 600 m, 6.5.1978, *Berkeley* 23 (holotype, E).
Synonyms: *Pulicaria rauhii* E.Gamal-Eldin (1981); *P. omanensis* subsp. *millerı* E.Gamal-Eldin (1986); *P. hadramautica* E.Gamal-Eldin & Boulos (1993).
Vernacular name: khokhawoat (Harsusi).

Description: Cushion forming shrublet, 0.5 m high, densely or laxly pilose and thus green to greyish-green. Leaves 5–25 × (2)3–7 mm, linear, linear-spatulate to broadly lanceolate,

sometimes folded along the midrib or involute, basally attenuate and semiamplexicaul to clasping, papery thin to somewhat fleshy, entire or with a few horny teeth in the distal half or dentate all along the margin, apically acute or rounded, usually mucronate. Capitula radiate, single or by few at the end of leafy branches. Involucre ± 4–6 mm long, phyllaries linear-lanceolate, > 1 mm wide. Flowers yellow; ray flowers pistillate, ray lamina ± 2 mm long, disk flowers perfect, tubular. Achenes ± 1.5 mm long, almost cylindric, glabrous to apically and basally weakly hairy. Pappus of a corona 0.1–0.5 mm long and 12–20 flat bristles, ± 3 mm long.

Flowering and fruiting: All around the year.

Distribution and habitat: Scattered all across Oman, but more common in the southern parts, from the coastal plains to mountain plateaus, in open habitats on rocky slopes, in gravelly, stony sites, wadi beds. *Altitude*: 50–900 m. Distributed in the southern Arabian Peninsula. Elsewhere in the Arabian Peninsula found in southeastern Yemen.

Distribution map & Illustration: 893.

Notes: The species is endemic to Oman and southeastern Yemen. Variation in leaf size (smaller in the coastal lowland, larger on the mountains), leaf texture (thin to somewhat fleshy) and leaf shape as well as in the density of the indumentum is considerable but continuous. Sometimes plants are found with galls in the leaf axils looking like small cotton-wool balls.

8. ***Pulicaria pulvinata*** E.Gamal-Eldin, Notes R.B.G. Edinb. 43: 481 (1986).
Type: Oman, Khor Dirif, 1.10.1984, *A. Miller* 6508 (holotype, E; isotype, ON).
Vernacular name: khokhawoat (Harsusi)

Description: Mat forming perennial with prostrate, delicate, leafy, long-hairy stems. Leaves obovate, entire, up to 5 × 3 mm, densely pilose. Involucre 4.5–5.5 mm long. Capitula very inconspicuously radiate; solitary, on up to ± 3 cm long, erect, filiform peduncles. Flowers pale yellow, marginal flowers pistillate with very indistinct ray lamina; disc flowers perfect, tubular. Achenes 1.3–1.4 mm long, cylindric, straw-coloured, smooth, apically (and sometimes, but less, basally) somewhat hairy. Pappus of a corona ± 0.4 mm long and ± 10 bristles ± 3 mm long.

Flowering and fruiting: September to April (?).

Distribution and habitat: Central Oman, on the Sahil al Jazir coast, between Ras Madrakah and Ras Shuwainah.

Distribution map & Illustration: 894.

Notes: The species is endemic to Central Oman.

9. ***Pulicaria semhanensis*** N.Kilian & P.Hein, Willdenowia 29: 189 (1999).
Type: Oman, Dhofar, Jebal Semhan, summit plateau, 1300–1400 m, 8.10.1998, *P. Hein & N. Kilian NK* 5591 (holotype, B; isotypes E, K, ON, S).

Description: Perennial 5–10 cm high, forming a small cushion of densely tufted leaf rosettes. Leaves, flowering shoots and outer involucral bracts densely adpressed-white-hairy. Rosette leaves oblanceolate, acute, up to 4.5 × 1 cm, the upper third with 2–5 teeth on each side. Flowering shoots ascending-erect, up to 8 cm long, each with a few small leaves and a single terminal capitulum. Capitula very inconspicuously radiate, with over 100 flowers. Involucrum 6–7 mm long, 12–15 mm in diameter. Flowers brownish deep purple; marginal flowers pistillate with extremely reduced ray lamina, disk flowers perfect, tubular. Achenes 1.7–1.9 mm long, pale brownish, almost terete. Pappus of a corona of scales up to 0.5–0.8 mm long and 10–12 easily detachable bristles 4–5 mm long.

Flowering and fruiting: September to January (?).

Distribution and habitat: Southern Oman, Dhofar, Jebal Semhan, on the summit plateau, in silt between rocks. *Altitude*: 1300–1400 m. The species is endemic to Dhofar and only known from the summit plateau of Jebal Semhan.

Distribution map & Illustration: 895.

10. ***Pulicaria schimperi*** DC., Prodr. 7(1): 285 (1838).

Description: Annual to perennial herb, branched from base, 30–50 cm high, with a dense greyish-white, woolly indumentum, glabrescent. Leaves up to 10 × 4 cm, denticulate; lower leaves ovate to spatulate and basally attenuate, middle and upper leaves lanceolate to linear, often amplexicaul. Capitula radiate, single and long-pedunculate at the ends of branches. Involucre 5–7 mm long, hemispherical, 13–18 mm in diameter; outer phyllaries densely greyish-white woolly, herbaceous, inner with sparsely hairy and glandular, distally scarious with acuminate tip. Flowers yellow; ray flowers pistillate with ray lamina 6–10 mm long, disk flowers perfect, tubular. Achenes 1.5 mm long. Pappus of a corona 0.2–0.4 mm long and of 14–17 easily detachable bristles 2.5–3 mm long.

Flowering and fruiting: January to March.

Distribution and habitat: Northern Oman, Hajar mountains, in the upper foothills. *Altitude*: 400–500 m. Distributed in the Horn of Africa region and on the Arabian Peninsula. Elsewhere in the Arabian Peninsula in Saudi Arabia and Yemen.

Distribution map & Illustration: 896.

11. ***Pulicaria undulata*** (L.) C.A.Mey., Verz. Pfl. Casp. Meer.: 79 (1831).
subsp. ***undulata***

Basionym: *Inula undulata* L. (1767). *Synonyms*: *Pulicaria crispa* (Forssk.) Oliv. subsp. *crispa* (1873); *Francoeuria crispa* (Forssk.) Cass. subsp. *crispa* (1825).
Vernacular name: gesgas, sabt, jathjath, gathgeth, jithjath, 'urayfijan

Description: Subshrub to 60 cm high, strongly branched from base; branches spreading, loosely leafy, white-tomentose and glabrescent. Leaves 0.5–5 × 0.2–1.2 cm, linear-lanceolate to linear-spatulate, with denticulate, strongly undulate margin and auriculate base.

greyish tomentose and with brown sessile glands. Capitula radiate, single at the end of the branches, on densely glandulose peduncles. Involucre ± 5 mm long, hemispherical; phyllaries glabrous, all < 1 mm wide. Flowers yellow; ray flowers pistillate, ray lamina 1–1.5 mm long; disk flowers perfect, tubular. Achenes 0.5–1 mm long, cylindric. Pappus of a corona of 0.3–0.4 mm long scales connate to 7–10 bristles, 2–3 mm long, both caducous together as a whole.

Flowering and fruiting: January to March in Northern Oman; in Southern Oman from October(?) to March(?).

Distribution and habitat: Throughout Oman, prefering sandy or silty ground, often in wadi beds. *Altitude*: 0–1200 m. The typical subspecies is distributed from the Canary Islands across N Africa (extending to the Horn of Africa), the SE Mediterranean, the Arabian Peninsula and Iraq to India. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 897.

Notes: *Pulicaria undulata* is one of the most widespread species of the genus and several subspecies have been recognised. In the Arabian Peninsula only the typical subspecies is present.

Pulicaria gamal-eldiniae N.Kilian & P.Hein is so far known from the coastal mountains in Al-Mahra, SE Yemen, between Jebal Sharwayn and 52°34'E and may perhaps also be present in Southern Oman, Dhofar. It may occur on the coast, in sparsely vegetated rocky slopes at lower altitudes in areas less affected by the summer monsoon. It is a dwarf shrub with weakly fleshy, narrowly spatulate leaves to 25 × 7 mm, with 10–15 mm wide hemispherical involucres and ray flowers with 5–6 mm long ray lamina. The achenes have a very conspicuous constriction in the middle third.

46. **Rhanterium** Desf.

Three species of subshrubs and shrublets, distributed disjunctly in NW Africa and SW Asia.

Rhanterium epapposum Oliv., Hooker's Icon. Pl. 14: t. 1367 (1881).
Synonym: *Asteriscus arabicus* Velen. (1911).
Vernacular name: arfaj.

Description: Greyish cushion forming subshrub to 70 cm, strongly and intricately branched from the base; young branches slender, adpressed-white-tomentose. Leaves linear to narrowly elliptic, to 40 × 3 mm, entire to remotely dentate, lanate and glabrescent, somewhat fleshy. Capitula radiate, single at the end of branches, deciduous at fruiting. Involucre hemispherical, ± 10 mm in diameter and 5–7 mm long, phyllaries many, yellowish, coriaceous, lanceolate, acute, imbricate. Receptacle with 5–7 mm long, linear-lanceolate, fimbriate paleae. Flowers yellow; ray flowers pistillate, ray lamina 4–6 mm long; disk flowers perfect, tubular. Achenes 2–3 mm long. Pappus absent.

Flowering and fruiting: January to May.

Distribution and habitat: Northern Oman, western foothills of southern Ru'us al-Jibal, western Hajar mountains; sand and gravel plains, gravelly and rocky slopes at lower altitudes. Distributed in SW Iraq, the central and eastern Arabian Peninsula, southeastern coastal Iran and adjacent Pakistan. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait (national flower), Qatar, Saudi Arabia, UAE.

Distribution map & Illustration: 898.

Notes: The species, which is the dominant element of a lowland shrublet community widespread in the eastern Arabian Peninsula, only touches Oman in the northwest.

XI. **Tribe Athroismeae**

47. **Blepharispermum** DC.

Fifteen species of shrubs or small trees distributed in tropical Africa, the southern Arabian Peninsula, S India and Sri Lanka.

Blepharispermum hirtum Oliv., Hooker's Icon. Pl. 25: t. 2435 (1896).
Type: [Oman], Dhofar Mts, Wadi Derbat, 300 ft, 1895, *J.T. Bent* 122 (holotype, K).
Vernacular name: khoft (Jibbali).

Description: Deciduous shrub or small tree, to 5 m; branches greyish-white with prominent lenticels. Leaves alternate, petiole 0.5–2.5 cm, lamina to 20 × 8 cm, ovate to ovate-oblong, base rounded, apex acute, entire to sinuate-dentate, villous below, glabrescent above. Capitula discoid, arranged in terminal, secondary, many-capitulate glomerules, 1.5–2 cm in diameter and containing up to ± 100 capitula. Involucre of the single, 4-flowered capitulum 4–5 mm long, of 2 green, spatulate phyllaries thickened towards apex and subtending the 2 pistillate flowers. Receptacle with 2 phyllary-like, 5–7.5 mm long paleae enveloping the 2 perfect but functionally staminate flowers, and 1–2 narrow, solitary, bilobed paleae. Flowers white, tubular. Achenes 2.5–3 mm long, compressed, obovate in outline, marginally hairy. Pappus of flat, filiform scales up to 2.5 mm long.

Flowering and fruiting: July to October.

Distribution and habitat: Southern Oman, Dhofar, often one of the dominant large shrubs in the deciduous woodlands and thickets on the lower slopes of the escarpment mountains, with *Boscia*, *Commiphora*, *Anogeissus*, *Delonix*, etc. *Altitude*: 60–700 m. A near endemic also found in SE Yemen.

Distribution map & Illustration: 899.

Notes: The wood of the species has been used as building material and also for firewood.

Blepharispermum hirtum is closely related to *B. villosum* and *B. fruticosum* from E Africa, whereas more distant to *B. yemense* from N Oman and SW Yemen (Eriksson 1992), which is the only other species of this genus in the Arabian Peninsula.

XII. **Tribe Eupatorieae**

48. **Ageratum** L.

About 40 species, distributed from Florida, the Caribbean and Mexico to Argentina; one species introduced as a weed and widely naturalised in tropical regions of the world.

Ageratum conyzoides L., Sp. Pl.: 839 (1753).

Description: Annual herb, up to 70 cm, pilose; stems erect to ascending. Leaves opposite, 2–6 × 1.5–4 cm, ovate, acute to rounded, basally cuneate, margins crenate, with thin petiole to 3 cm. Capitula discoid, arranged in cymosely branched clusters. Involucre 3–5 mm long, cup-shaped; phyllaries linear-lanceolate, acute, herbaceous, with 2 white ribs and narrow, ± fimbriate scarious margins. Flowers 35–80, white to violet, tubular, perfect, glabrous. Achenes 1–2 mm long, 5-angled, black, scabrous on the ridges. Pappus 1.5–3 mm long, of 5(–6) rigid, scarious scales abruptly tapering into a scabrous awn.

Flowering and fruiting: January to April, perhaps under suitable conditions also in other months.

Distribution and habitat: Northern Oman, in cultivated and disturbed places, in moist and shade; weedy. *Altitude*: ± 400 m. Native to Central and South America, naturalised throughout the tropics. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen; also found on Soqotra.

Distribution map & Illustration: 900.

XIII. **Tribe Tageteae**

49. **Flaveria** Juss.

Twenty-one species, distributed in the Americas (especially SW North America) and Australia, two species are pantropical weeds.

Flaveria trinervia (Spreng.) C.Mohr, Contr. U.S. Natl. Herb. 6: 810 (1901).
Basionym: *Odera trinervia* Spreng. (1800); *Synonym*: *Flaveria repanda* Lag. (1816).

Description: Annual herb to 50 cm high, stems branched, erect to ± decumbent, often reddish, glabrous. Leaves opposite, 2–8 × 0.5–2 cm, ovate or lanceolate to oblanceolate, margins ± serrate, apex acute, attenuate towards the base. Capitula 1–2-flowered, forming dense axillary clusters, up to 2 cm across and surrounded by leaves, the marginal capitula radiate, the inner discoid. Involucre 3–4 mm long; phyllaries 2, enveloping the mature achenes. Flowers pale yellow, ray flower pistillate, ray lamina suborbicular, up to ± 1 mm long; disc flowers tubular, perfect. Achenes ± 2 mm long, narrowly obovoid, ribbed, blackish. Pappus absent.

Flowering and fruiting: September to May.

Distribution and habitat: Northern Oman, in irrigated places, date gardens, farms, near

falaj and outflow of water channels, in moist silty soil; tolerant of medium saline soils. *Altitude*: 50–400 m. A pantropical weed native to tropical America. Elsewhere in the Arabian Peninsula found in Bahrain, Qatar, Saudi Arabia, UAE, Yemen.

Distribution map & Illustration: 901.

50. **Tagetes** L.

About 50 species, distributed in tropical and subtropical America, a few species introduced and widespread in the Old World.

Tagetes erecta L., Sp. Pl.: 887 (1753).

Description: Annual herb to 1 m high, stem erect, leafy. Leaves opposite, the apical alternate; elliptic in outline, pinnatisect with linear-elliptic, entire to dentate segments, glandular, otherwise glabrous. Capitula radiate, solitary, on long, apically thickened peduncles. Involucre 20–22 mm long, of 8–9 phyllaries in one row connate for most of their length, with small elliptic to roundish glands dispersed on their outer surface. Flowers golden yellow; ray flowers 5–8, pistillate, ray lamina 10–20 mm long, disk flowers perfect, tubular, many. Achenes 9–11 mm long, narrowly cylindric, ribbed, black. Pappus whitish, of 1–2, up to ± 15 mm long awn-like scales and 3–4 linear, truncate, 4–6 mm long, partly connate scales.

Flowering and fruiting: September to October.

Distribution and habitat: Southern Oman, Dhofar, Jebal Qara, as a garden escape in a disturbed site with open scrub. Originating from the Americas, widely cultivated in the tropics and subtropics of the Old World, sometimes naturalised. Elsewhere in the Arabian Peninsula found in N Yemen; commonly cultivated as a potherb.

Distribution map & Illustration: 902.

Notes: The species is reported here for the first time from Oman. It was recorded at Tawi Atair, near the sinkhole in 1998 as a garden escape (*Kilian* 5560, B). It is not known whether this is an only ephemeral occurrence or whether the species is establishing and spreading.

51. **Thymophylla** Lag.

Thirteen species of SW USA and Mexico; a few species are introduced to other parts of the Americas, one also to Africa and Asia.

Thymophylla tenuiloba (DC.) Small, Fl. S.E. U.S.: 1295 (1903).

Basionym: *Hymenatherum tenuilobum* DC. (1836); *Synonym*: *Dyssodia tenuiloba* (DC.) B.L.Rob. (1913).

Description: Annual herb to 20 cm high, sparsely short-hairy, with basally branched, spreading-erect, leafy stems. Leaves rarely opposite to alternate, to 2 × 1.5 cm, pinnatisect

into linear to filiform, mucronulate, sparsely gland-dotted lobes. Capitula radiate, at the end of branches on 3–6 cm long wiry peduncles. Involucre turbinate-campanulate, 5–7 mm long; outermost phyllaries few, all free, linear-lanceolate, up to 1/3 as long as the inner ones; inner phyllaries green, connate to 4/5 of their length, the tips scarious, obtuse, with ciliate to fimbriate margins and 1–4 conspicuous, ovate to elliptic, orange glands. Flowers golden yellow, ray flowers pistillate, ray lamina 4–7 mm long, disk flowers numerous, tubular, perfect. Achenes 2.5–3.5 mm long, slenderl obpyramidal, faintly ribbed, blackish. Pappus 3–3.5 mm long, of 10–12 scales, each with a central and 2–4 lateral awns.

Flowering and fruiting: August to October.

Distribution and habitat: Southern Oman, Dhofar, Salalah plain, in and around farmland near water. *Altitude*: ± 10–50 m. Originating from NW Mexico and SW Texas, introduced (as an ornamental or unintentionally) and adventive beyond in other parts of the Americas and, rarely so, in Africa and Asia. Not known elsewhere in the Arabian Peninsula.

Distribution map & Illustration: 903.

Notes: The species is only known from two collections made in 1984 and 1989 in the environments of Salalah and identified as "*Dyssodia tenuifolia*" (as such but misspelled as "*tenuiflora*" listed in Ghazanfar, 1992). Its current status is unknown. The name *Dyssodia tenuifolia* (Cass.) Loes. (synonym: *Thymophylla tenuifolia* (Cass.) Rydb.) actually refers to a species of the central Mexican highlands not known to be introduced elsewhere.

XIV. **Tribe Millerieae**

52. **Acanthospermum** Schrank

A genus of six species native to the Americas from Honduras south to Argentina; one species introduced and widely naturalised in tropical to warm-temperate regions of the world.

Acanthospermum hispidum DC., Prodr. 5: 522 (1836).

Description: Annual herb, up to 40 cm, hispid in all parts, stems erect, dichotomously branched, leafy. Leaves opposite, 25–35 × 8–12 mm, oblong to obovate, apex acute to obtuse, base cuneate, margins ± entire to irregularly dentate, gland-dotted. Capitula inconspicuously radiate, solitary, sessile, axillary. Involucre 5–7 mm, herbaceous, soon pushed apart by the ripening achenes. Receptacle with membranous paleae subtending the flowers. Flowers pale yellow, ray flowers female, ray lamina ± 1 mm long; disc flowers functionally male, tubular. Achenes 4–5 mm (without spines), laterally compressed, obtriangular in outline with 2 apical divergent spines 3–4 mm long, and many smaller lateral hooked spinules, green, becoming tawny when mature. Pappus absent.

Flowering and fruiting: February to March.

Distribution and habitat: Masirah Island, in sandy soil and sand beside roads; not common. *Altitude*: 10–100 m. Native of South America, now a widespread weed in tropical

and subtropical regions. Elsewhere in the Arabian Peninsula found in Yemen; also found on Soqotra.

Distribution map & Illustration: 904.

XV. **Tribe Coreopsideae**

53. **Bidens** L.

About 350 species, cosmopolitan in distribution, with centres of diversity in Africa and Central America; several species widespread as weeds.

Leaves pinnately lobed with 3–5 leaflets to bipinnatisect with up to 9 leaflets; involucre at fruiting ± 10–25 mm long; ray flowers, if present, white ..... 1.**B. biternata**
Leaves pinnately lobed with 3–5 leaflets; involucre at fruiting ± 9–12 mm long, ray flowers, if present, yellow ..... 2.**B. pilosa**

1. ***Bidens biternata*** (Lour.) Merr. & Sherff, Bot. Gaz. 88: 293 (1929).

Basionym: *Coreopsis biternata* Lour. (1790); *Synonym*: *Bidens chinensis* (L.) Willd. (1803).

Description: Annual herb to 1 m high, stem erect, leafy, branched. Leaves opposite, petiolate, broadly ovate in outline, to 20 × 12 cm, pinnately lobed with 3–5 leaflets to bipinnatisect with up to 9 leaflets, leaflets ovate to lanceolate, serrate, acute. Capitula radiate (sometimes discoid), in laxly paniculiform terminal synflorescences. Involucre 5–7 mm long at flowering, prolonging up to ± 20 mm at fruiting; outer phyllaries green, linear to narrowly spatulate, inner phyllaries yellowish-green with yellowish-white scarious margins. Receptacle with light brown, membranous paleae. Flowers yellow, ray flowers (sometimes absent) 2–5, white, sterile, ray lamina 3–6 mm long, with orange striations; disk flowers perfect, tubular. Achenes 6–20 mm long, slender, 4-angular, black. Pappus of 2–5, retrorsely barbed, up to ± 4 mm long awns.

Flowering and fruiting: August to November, in suitable places probably all around the year.

Distribution and habitat: Southern Oman, Dhofar, margins of irrigated cultivations, moist places in disturbed areas, weedy. A pantropical weed. Elsewhere in the Arabian Peninsula found in Saudi Arabia, Yemen.

Distribution map & Illustration: 905.

2. ***Bidens pilosa*** L., Sp. Pl.: 2: 832 (1753).

Description: Annual herb to 1 m high; stem erect, leafy, branched. Leaves opposite, up to 10 × 5 cm, pinnately lobed with 3–5 leaflets, leaflets ovate to ovate-lanceolate, terminal one the largest, serrate, acute. Capitula radiate (sometimes discoid), in laxly paniculiform terminal synflorescences, peduncles 8–10 cm long. Involucre 5–7 cm long at anthesis, prolonging up to ± 12 mm at fruiting; outer phyllaries green, narrowly spatulate, acute; inner phyllaries yellowish-green with yellow scarious margins. Receptacle with light-brown,

membranous paleae. Ray flowers (sometimes absent) 4–8, sterile, ray lamina 7–9 mm long, with orange striations; disc flowers yellow, tubular, perfect. Achenes 4–12 mm long, slender, 4-angular, black. Pappus of 2–4 retrorsely barbed, 2–3 mm long awns.

Flowering and fruiting: February to April; September to October.

Distribution and habitat: Northern and Southern Oman, in the foothills, in undergrowth on wadi banks, in disturbed and irrigated land; weedy. *Altitude*: 100–350 m. A cosmopolitan weed found in most tropical and subtropical regions. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 906.

XVI. **Tribe Heliantheae**

54. **Blainvillea** Cass.

Pantropical genus of about five annual to perennial herbs.

Blainvillea acmella (L.) Philipson, Blumea 6: 350 (1950).
Basionym: *Verbesina acmella* L., Sp. Pl.: 901 (1753); *Synonyms*: *Blainvillea dichotoma* (Murr.) A.Stewart (1911); *Verbesina dichotoma* Murr. (1779); *B. rhomboidea* Cass. (1823); *B. gayana* Cass. (1827).

Description: Annual herb, hispidulous in all parts, with an erect, branched, leafy stem to 1 m high. Leaves opposite, up to 10 × 4 cm, (narrowly) ovate, basally attenuate into a petiolate base and apically acuminate, margins serrate. Capitula inconspicuously radiate, on wiry, several cms long peduncles axillary and at the end of the branches. Involucre 4–7 mm long, plump-cylindric at flowering to subglobose at fruiting; outer phyllaries lanceolate, acute, inner ones spatulate, apically abruptly truncate and 1–few-dentate, glandular. Receptacle with apically truncate and lacerate, glandular paleae enfolding the disk flowers and conspicuously overtopping the involucre. Flowers white, ray flowers few, pistillate, ray lamina 1–1.5 mm long, disk flowers perfect, tubular. Achenes 4–6 mm long, slender-obpyramidal, 3-angular, blackish. Pappus tiny, of a few < 1 mm long, barbellate bristles from a small corona in the centre of the truncate achene apex.

Flowering and fruiting: September to November (?).

Distribution and habitat: Southern Oman, Dhofar, in undergrowth of disturbed *Anogeissus* woodland in moist places. *Altitude*: 300–350 m. Originating from tropical South America and pantropically naturalised in moist habitats. Not known from elsewhere in the Arabian Peninsula but present on Soqotra since the 19th century.

Distribution map & Illustration: 907.

Notes: The species is recorded here for the first time from Oman and the Arabian Peninsula and is so far known to us only from a single collection from Wadi Hinna in Dhofar (4.10.1998, *P. Hein* 5290, B).

55. **Eclipta** L.

Four species native to tropical America and Australia, one species introduced to tropical and subtropical regions elsewhere.

Eclipta prostrata (L.) L., Mant. Pl. Altera: 286 (1771).

Basionym: *Verbesina prostrata* L. (1753); *Synonyms*: *Verbesina alba* L. (1753); *Eclipta alba* (L.) Hassk. (1848).

Description: Annual herb up to 30 cm; stems ± erect to prostrate, adpressed-pubescent, purplish-brown. Leaves opposite, 25–60 × 9–15 mm, lanceolate to ovate-lanceolate, base cuneate, apex acute, margins shallowly serrate, adpressed-pubescent to scabrous, midrib prominent on the lower surface; petiole up to 6 mm. Capitula radiate, terminal or axillary, on peduncles to ± 1 cm long. Involucre 4–6 mm long; the outer phyllaries green, ovate-lanceolate, with stiff hairs, the inner smaller than the outer, pubescent at the apex. Receptacle with linear, fimbriate paleae. Ray flowers white, pistillate, ray lamina 1–2 mm long; disc flowers white, perfect, tubular. Achenes 2–3 mm long, compressed, 3-angled, verrucose. Pappus a minute hairy corona, seemingly being absent.

Flowering and fruiting: February to March; September to October.

Distribution and habitat: Northern and Southern Oman, in sandy water courses of wadis, coastal plains, farms, village gardens, edges of falaj and disturbed moist and irrigated places. *Altitude*: 10–400 m. A pantropical weed of moist, disturbed land. Elsewhere in the Arabian Peninsula found in Bahrain, Kuwait, Qatar, Saudi Arabia, UAE, Yemen; also found on Soqotra.

Distribution map & Illustration: 908.

56. **Parthenium** L.

Sixteen species, distributed in North America, Central America, the Caribbean and northern South America; one species widespread beyond as a weed and ruderal.

Parthenium hysterophorus L., Sp. Pl.: 988 (1753).

Description: Annual herb up to 80 cm high, puberulous and glandular, stem apically branched. Leaves elliptic to ovate in outline, up to 20 × 10 cm, deeply pinnately to bipinnately dissected with obtuse segments. Capitula in lax paniculiform synflorescences, radiate. Involucre hemispherical, 2–3 mm long and 3–5 mm in diameter, outer phyllaries 5, inner phyllaries 5. Flowers white; ray flowers 5, pistillate, ray lamina 0.5–1 mm long, roundish; disk flowers functionally staminate, tubular, 4-lobed, basally enclosed in a receptacular palea. Achenes (of the ray flowers) ± 2 mm long, black, obovoid, compressed, connate to the subtending inner phyllary and to a paleate disk flower on either side. Pappus of two obovate scales, 0.6–0.8 mm long.

Flowering and fruiting: Throughout the year.

Distribution and habitat: Southern Oman, Dhofar, along roadsides, disturbed sites and edges of cultivations. *Altitude*: up to 900(?) m. Pan(sub)tropical weed of Caribbean origin.

Distribution map & Illustration: 909.

Notes: The species is a recent introduction to the Arabian Peninsula, for the first time recorded from Dhofar in 1998, and from the neighbouring Al-Mahra region, SE Yemen in 2002 (Kilian & al., Willdenowia 32: 254. 2002). It is rapidly spreading to subtropical and tropical countries all around the world as an aggressive coloniser of fallow fields, roadsides, wasteland and overgrazed pastures and is a noxious weed. Livestock usually avoid the plant, but if browsed then the meat becomes badly tainted and unenjoyable. Regular long term skin contact with the plant produces acute dermatitis and asthma in humans.

57. **Sclerocarpus** Jacq.

Eight species, distributed in Africa and Mexico and Central America.

Sclerocarpus africanus Jacq., Icon. Pl. Rar. 1: 17, t. 176 (1781).

Description: Annual herb to 1 m, scabrid to hispid in all parts, with an erect, branched leafy stem. Leaves opposite in the basal portion of the stem, alternate higher up, to 1.5 × 6 cm, ovate, basally cuneate, petiolate, apically acute, dentate. Capitula radiate, single at the end of branches. Involucre of 5 leafy, 1–3 cm long, narrowly ovate phyllaries. Receptacle with 9–13 mm long paleae clasping the flowers and achenes. Flowers yellow, ray flowers few, pistillate, ray lamina 3–4 mm long; disk flowers perfect, tubular. Achenes 5–7 mm long, asymmetrically obovoid, black, overtopped by the firmly attached, clasping palaea. Pappus absent.

Flowering and fruiting: September to December.

Distribution and habitat: Southern Oman, Dhofar, in undergrowth of browsed *Anogeissus* woodland. *Altitude*: ± 300–900(?) m. A widespread, weedy, palaeotropical herb. Elsewhere in the Arabian Peninsula found in Yemen.

Distribution map & Illustration: 910.

ADDITIONAL TAXA AND THOSE EXPECTED TO BE IN OMAN

Three more species of genera so far not recorded for Oman occur in the UAE on Jebal Hafit (Jongbloed et al. 2003), near the border of Oman, and may also be present on Oman territory.

Two species, ***Xanthium strumarium*** L., a plant of waste and degraded land has recently been recorded from the Hajar Mountains in Wadi Tayyin and Wadi Al Khod from cultivated and ruderal places, and ***Tridax procumbens*** L., a tropical weedy perennial earlier known from Southern Oman, is now also recorded from the Muscat area in Northern Oman (Patzelt et al., Edinb. J. Bot. 71: 168, 2014).

Anvillea garcinii (Burm. f.) DC. [tribe Inuleae]
A cushing forming, intricately branched shrublet with whitish branches and ± adpressed-tomentose, spatulate, dentate leaves, conspicuously radiate yellow-flowered capitula single at the end of branches with leaf-like outer phyllaries.

Gymnarrhena micrantha Desf. [tribe Gymnarrheneae]
An acaulescent ephemeral forming a rosette of entire lanceolate leaves and with a few disciform capitula in the centre of the rosette and a few cleistogamous subterranean capitula.

Scorzonera tortuosissima Boiss. [tribe Cichorieae]
An intricately branched greyish-green perennial with white latex, terete leaves and ligulate yellow-flowered capitula.

Distribution Maps

Volume 3
Loganiaceae - Asteraceae

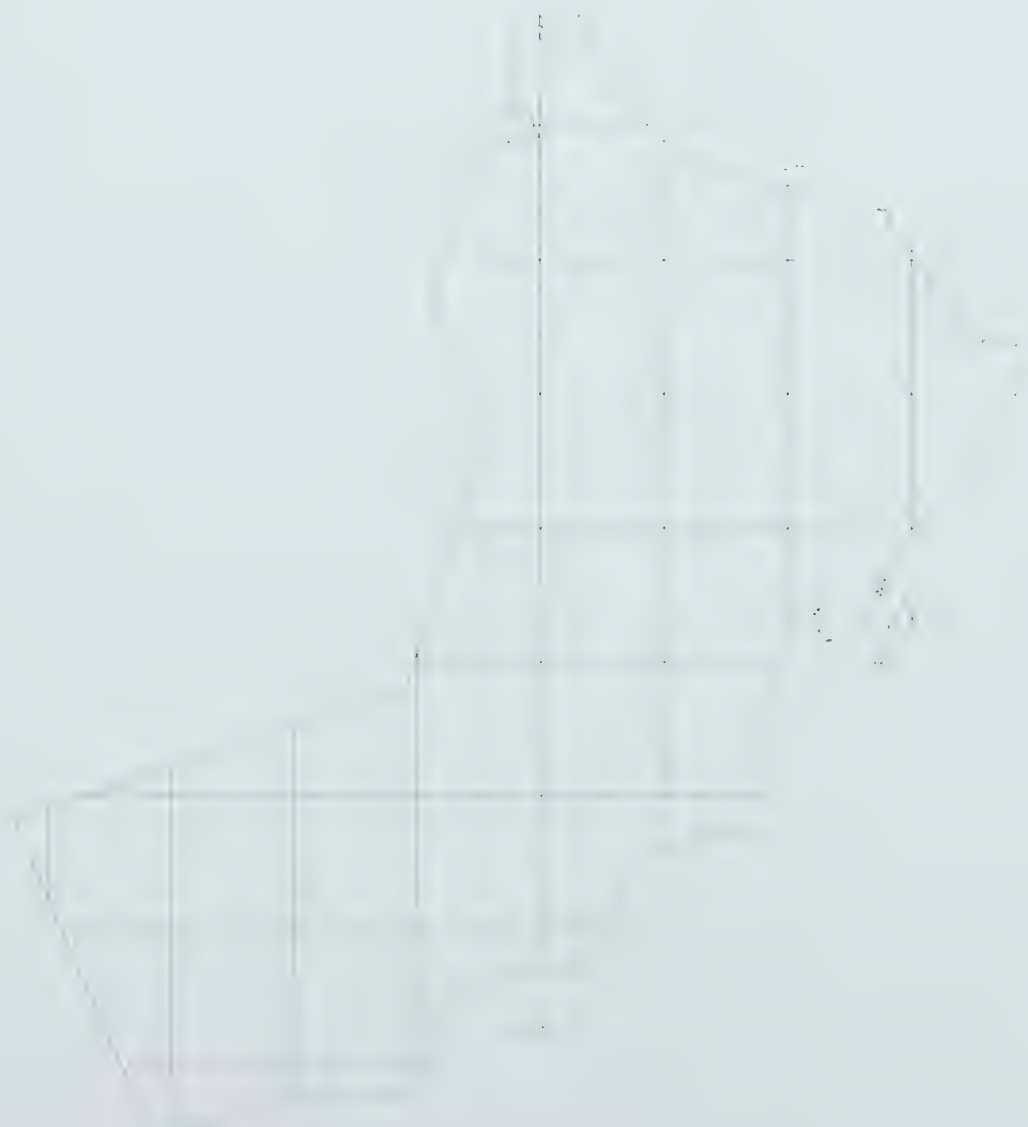

Fig. 535. Mitreola petiolata.

Fig. 536. Exacum affine.

Fig. 537. Exacum arabicum.

Fig. 538. Enicostema axillare.

Fig. 539. Canscora concanensis.

Fig. 540. Centaurium pulchellum.

Fig. 541. Adenium obesum.

Fig. 542. Rhazya stricta.

Fig. 543. Nerium oleander.

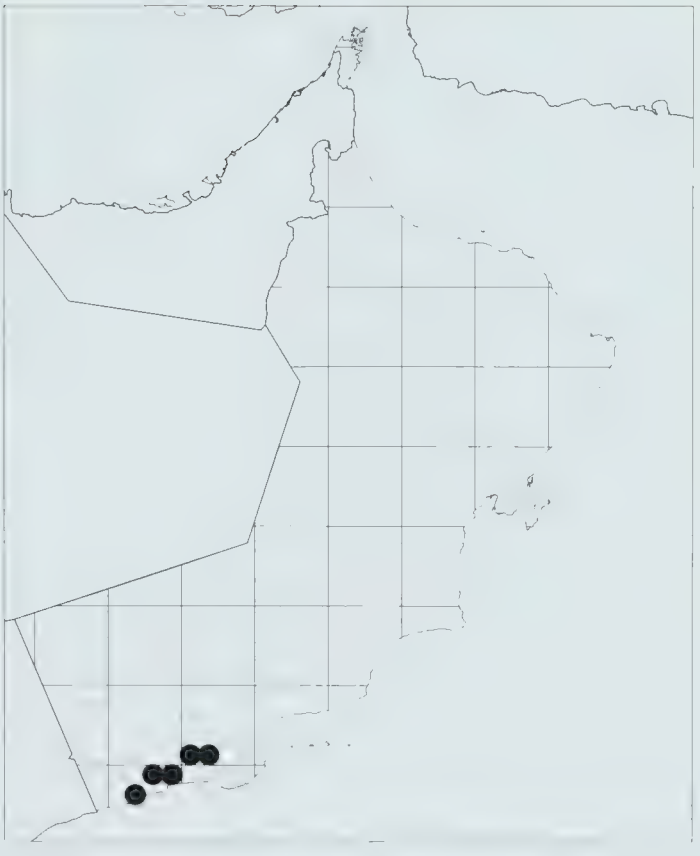

Fig. 544. Carissa spinarum.

Fig. 545. Periploca aphylla.

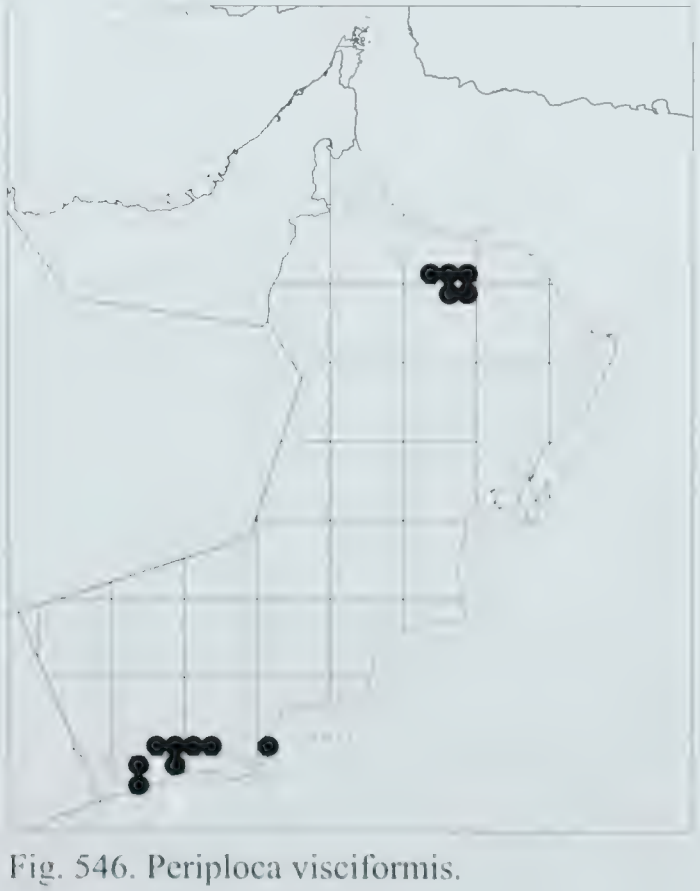

Fig. 546. Periploca visciformis.

Fig. 547. Raphionacme arabica.

Fig. 548. Cibirhiza dhofarensis.

Fig. 549. Glossonema varians.

Fig. 550. Calotropis procera.

Fig. 551. Gomphocarpus fruticosus.

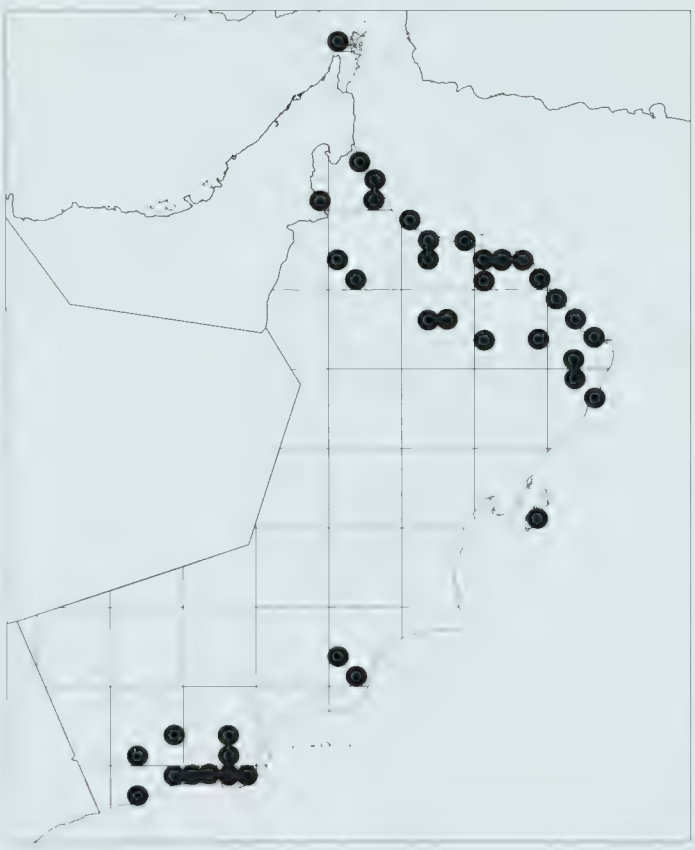

Fig. 552. Pergularia tomentosa.

Fig. 553. Pergularia daemia.

Fig. 554. Pentatropis nivalis

Fig. 555. Pentatropis bentii.

Fig. 556. Cynanchum gerrardii.

Fig. 557. Sarcostemma viminale.

Fig. 558. Leptadenia pyrotechnica.

Fig. 559. Ceropegia bulbosa.

Fig. 560. Ceropegia botrys.

Fig. 561. Caudanthera edulis.

Fig. 562. Desmidorchis adenensis.

Fig. 563. Desmidorchis arabica.

Fig. 564. Desmidorchis impostor.

Fig. 565. Desmidorchis flava.

Fig. 566. Desmidorchis tardelli.

Fig. 567. Desmidorchis penicillata.

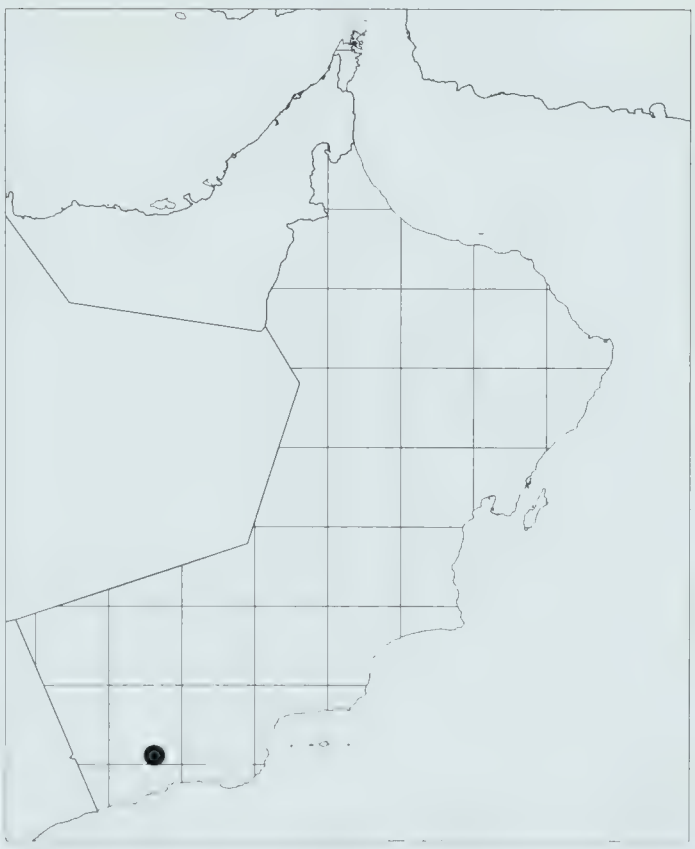

Fig. 568. Desmidorchis acutangla.

Fig. 569. Desmidorchis awdeliana.

Fig. 570. Monolluma quadrangula.

Fig. 571. Monolluma hexagona.

Fig. 572. Rhytidocaulon fulleri.

Fig. 573. Echidnopsis scutellata subsp. dhofarensis.

Fig. 574. Anomalluma mccoyi.

Fig. 575. Orbea nardii.

Fig. 576. Orbea luntii.

Fig. 577. Lycium shawii.

Fig. 578. Solanum nigrum subsp. nigrum.

Fig. 579. Solanum villosum subsp. miniatum.

Fig. 580. Solanum cordatum.

Fig. 581. Solanum incanum

Fig. 582. Solanum coagulans

Fig. 583. Solanum virginianum.

Fig. 584. Physalis angulata.

Fig. 585. Withania somnifera.

Fig. 586. Withania quaritica.

Fig. 587. Datura fastuosa.

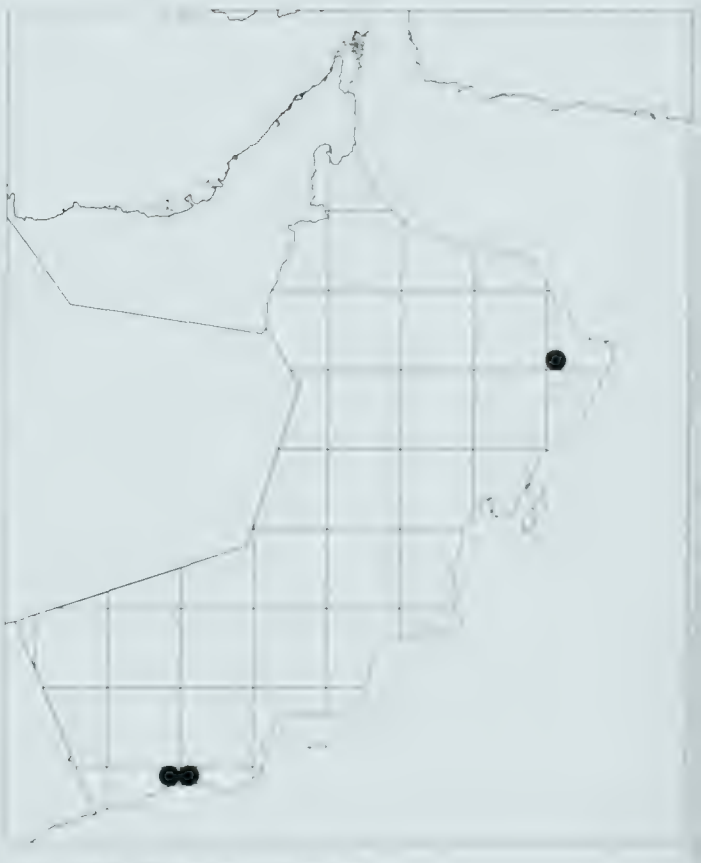

Fig. 588. Datura innoxia.

Fig. 589. Nicandra physalodes.

Fig. 590. Hyoscyamus muticus.

Fig. 591. Hyocyamus gallagheri.

Fig. 592. Hyocyamus flaccidus.

Fig. 593. Hildebrandtia africana subsp. arabica.

Fig. 594. Seddera glomerata subsp. dhofarensis.

Fig. 595. Seddera latifolia.

Fig. 596. Seddera velutina.

Fig. 597. Seddera retusa.

Fig. 598. Cressa cretica.

Fig. 599. Convolvulus acanthocladus.

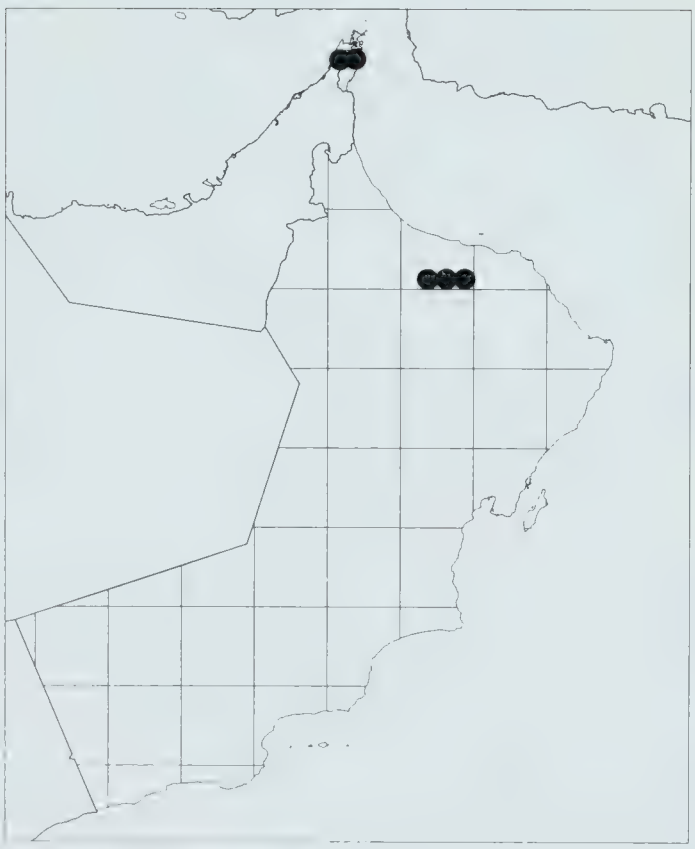

Fig. 600. Convolvulus ulicinus.

Fig. 601. Convolvulus hystrix.

Fig. 602. Convolvulus virgatus.

Fig. 603. Convolvulus glomeratus.

Fig. 604. Convolvulus prostratus.

Fig. 605. Convolvulus cephalopodus.

Fig. 606. Convolvulus oppositifolia.

Fig. 607. Convolvulus arvensis.

Fig. 606. Convolvulus fatmensis.

Fig. 609. Merremia somalensis.

Fig. 610. Ipomoea eriocarpa.

Fig. 611. Ipomoea sinensis subsp. blepharosepala

Fig. 612. Ipomoea nil.

Fig. 613. Ipomoea obscura.

Fig. 614. Ipomoea aquatica.

Fig. 615. Ipomoea pes-caprae.

Fig. 616. Ipomoea cairica.

Fig. 617. Ipomoea aitonii.

Fig. 618. Ipomoea turbinata.

Fig. 619. Stictocardia macalusoi.

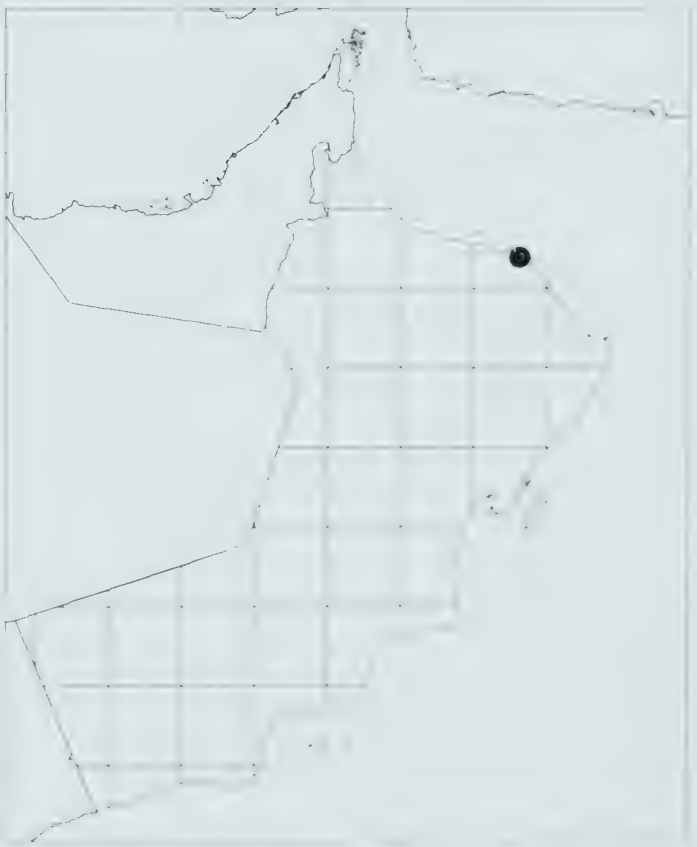

Fig. 620. Cuscuta pedicellata.

Fig. 621. Cuscuta planiflora.

Fig. 622. Cordia monoica.

Fig. 623. Cordia obovata.

Fig. 624. Cordia crenata subsp. crenata.

Fig. 625. Cordia quercifolia.

Fig. 626. Ehretia obtusifolia.

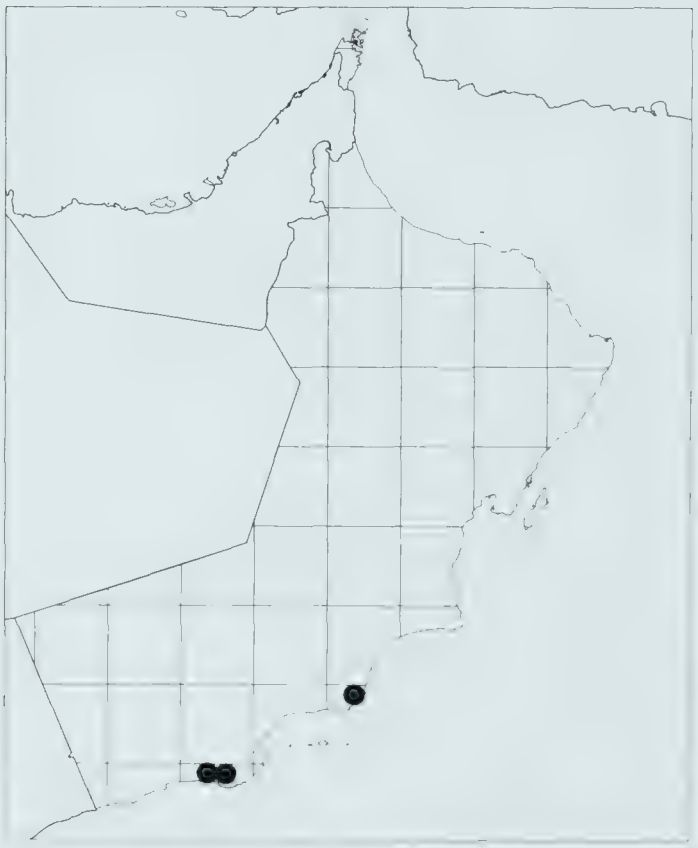

Fig. 627. Nogalia drepanophyllum subsp. drepanophyllum

Fig. 628. Heliotropium longiflorum.

Fig. 629. Heliotropium brevilimbe.

Fig. 630. Heliotropium ophioglossum.

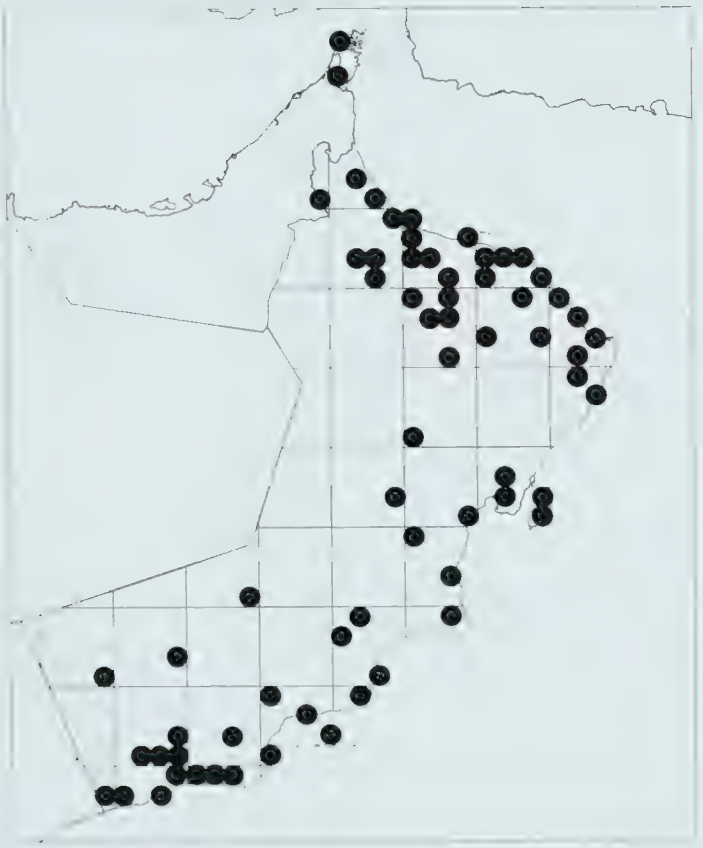

Fig. 631. Heliotropium bacciferum.

Fig. 632. Heliotropium pterocarpum.

Fig. 633. Heliotropium ovalifolium.

Fig. 634. Heliotropium strigosum.

Fig. 635. Heliotropium rariflorum.

Fig. 636. Heliotropium subspinosum.

Fig. 637. Heliotropium europaeum.

Fig. 638. Moltkiopsis ciliata.

Fig. 639. Ogastemma pusillum.

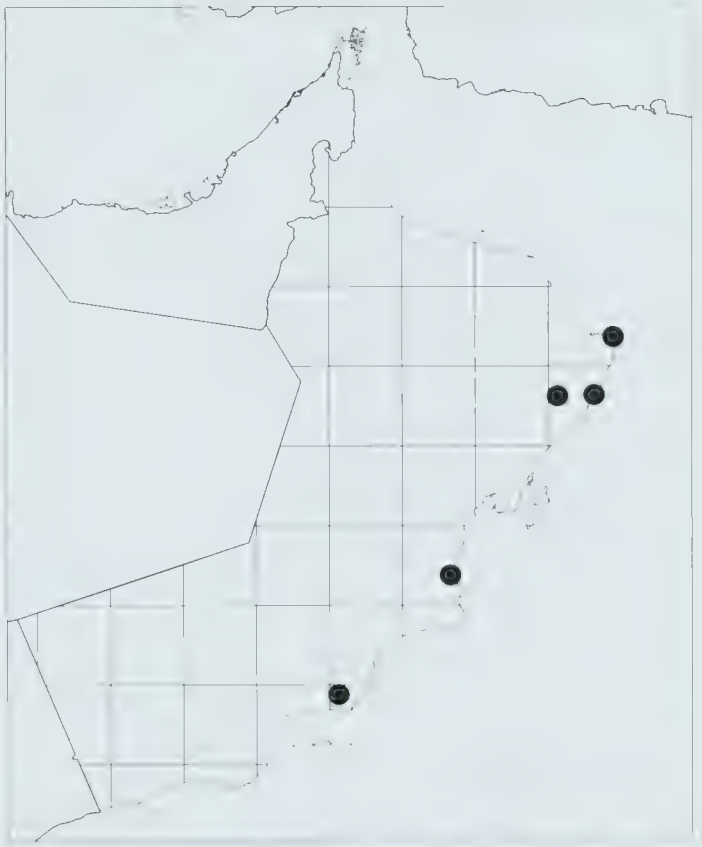

Fig. 640. Echiochilon jugatum.

Fig. 641. Echiochilon kotschyi.

Fig. 642. Echiochilon longiflorum.

Fig. 643. Echiochilon persicum.

Fig. 644. Echiochilon collenettei.

Fig. 645. Echiochilon arabicum.

Fig. 646. Echiochilon callianthum.

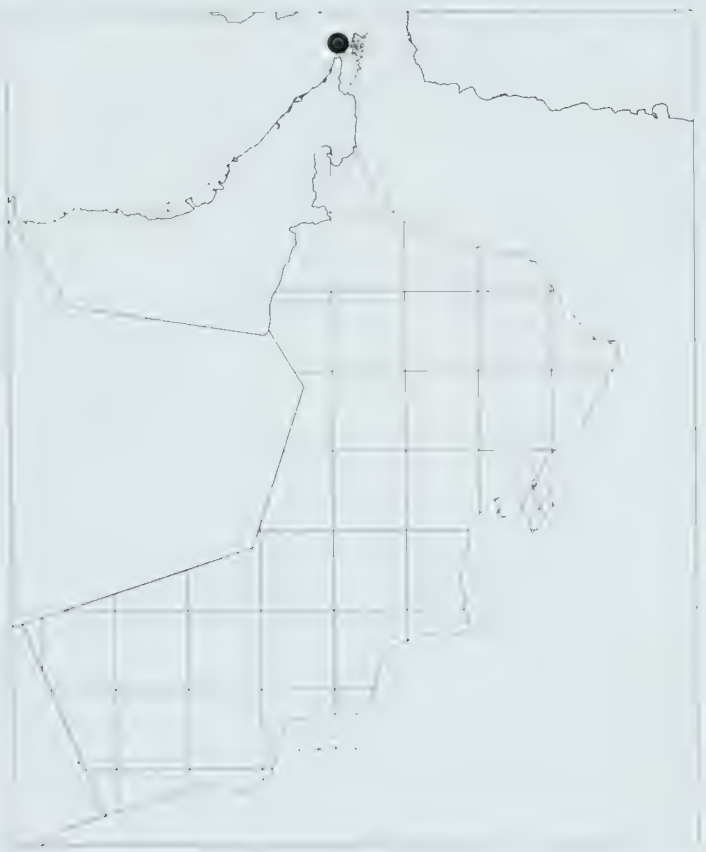

Fig. 647. Lappula spinocarpos.

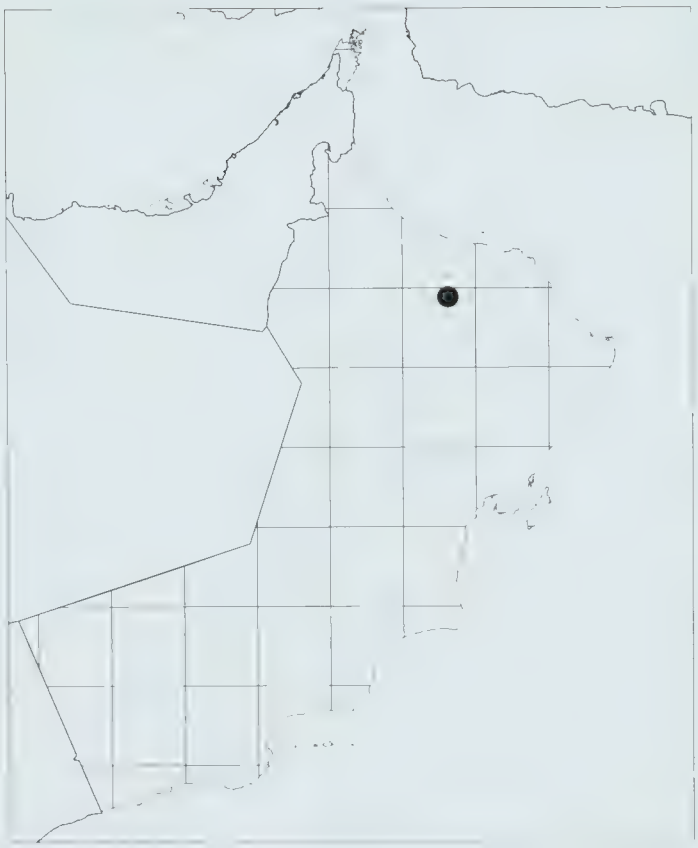

Fig. 648. Rochelia disperma.

Fig. 649. Asperugo procumbens.

Fig. 650. Paracaryum intermedium.

Fig. 651. Paracaryum caelestinum.

Fig. 652. Arnebia hispidissima.

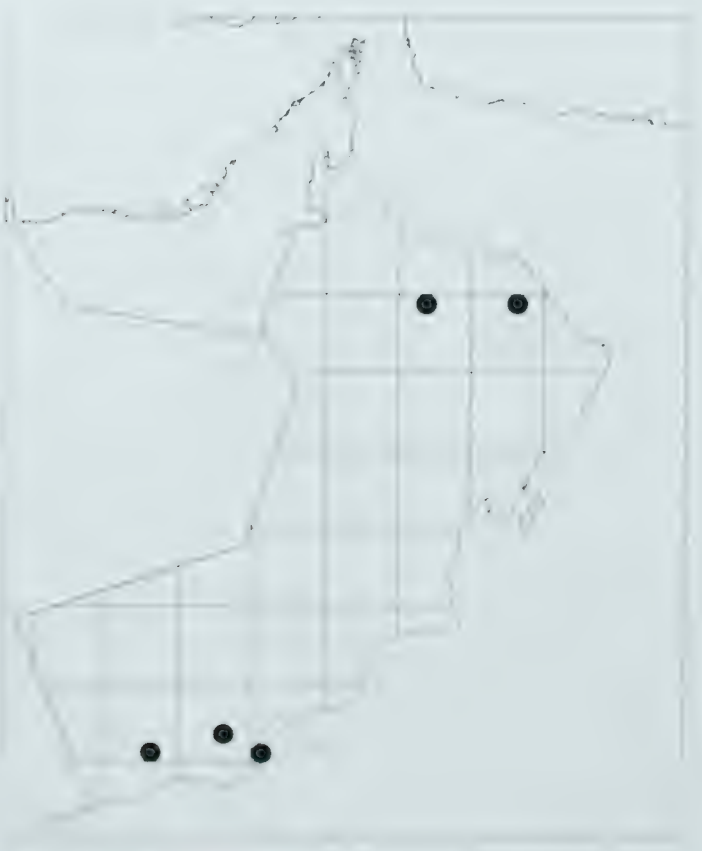

Fig. 653. Trichodesma africanum.

Fig. 654. Trichodesma ehrenbergii.

Fig. 655. Trichodesma hildebrandtii.

Fig. 656. Trichodesma cinereum.

Fig. 657. Gastrocotyle hispida.

Fig. 658. Chascanum sessilifolium.

Fig. 659. Priva adhaerens.

Fig. 660. Phyla nodiflora.

Fig. 661. Lantana viburnoides.

Fig. 662. Lantana petitiana.

Fig. 663. Avicennia marina.

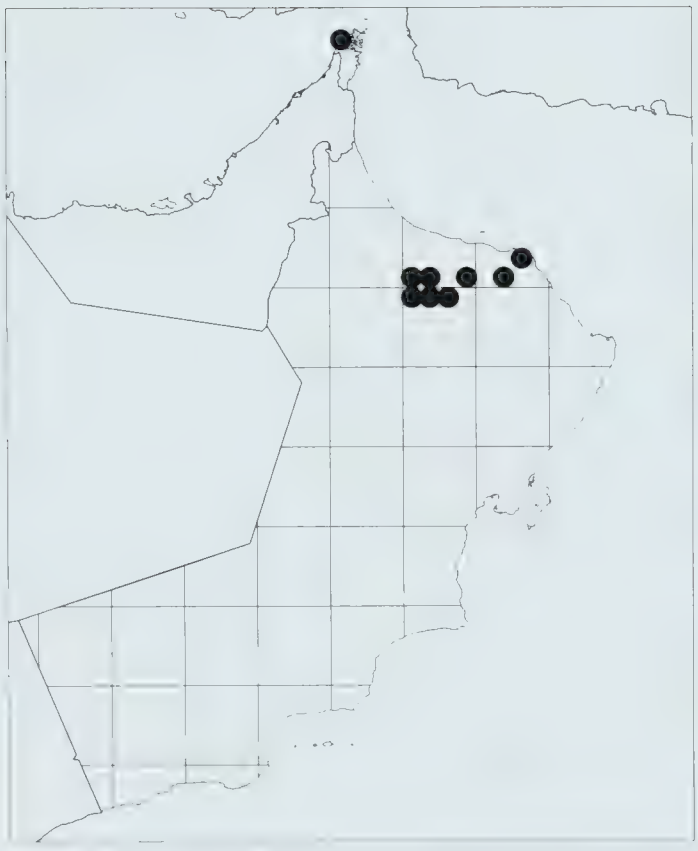

Fig. 664. Teucrium mascatense.

Fig. 665. Teucrium stocksianum subsp. stocksianum

Fig. 666. Teucrium stocksianum subsp. stenophyllum

Fig. 667. Teucrium nummularifolium.

Fig. 668. Teucrium yemense.

Fig. 669. Otostegia persica.

Fig. 670. Leucas urticifolia.

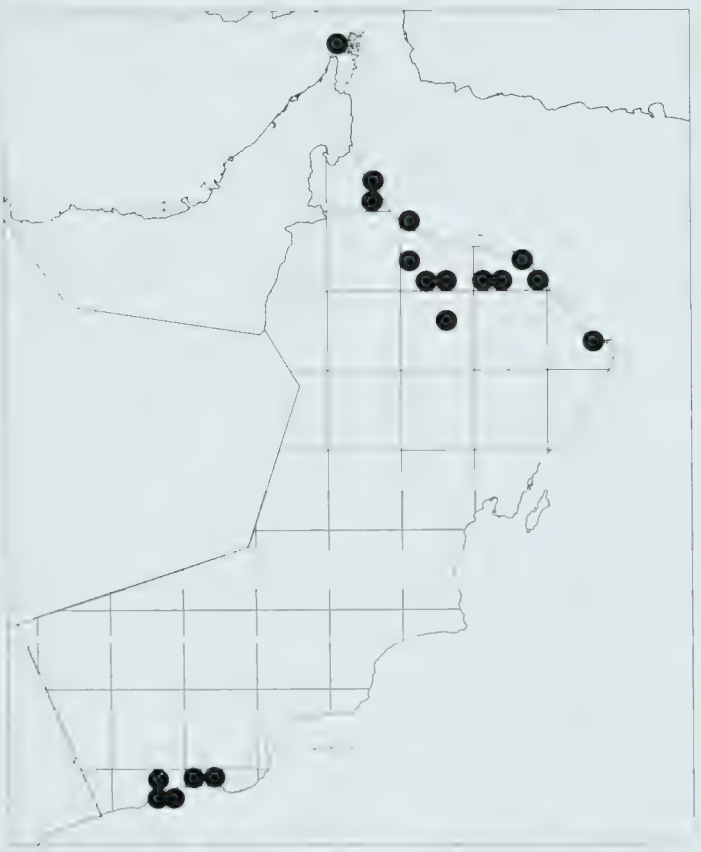

Fig. 671. Leucas inflata.

Fig. 672. Leucas dhofarensis.

Fig. 673. Salvia aegyptiaca.

Fig. 674. Salvia santolinifolia.

Fig. 675. Salvia macilenta.

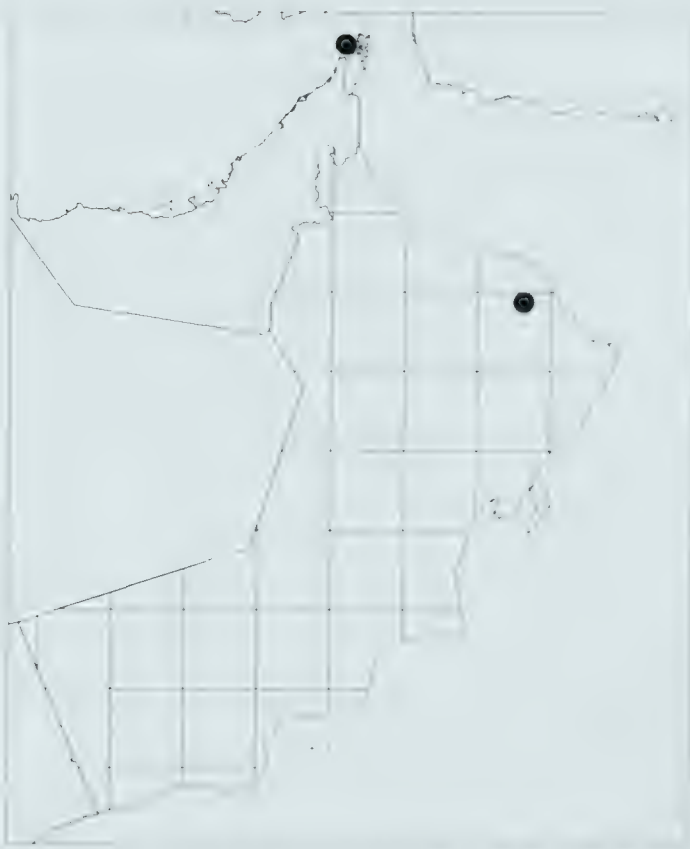

Fig. 676. Salvia macrosiphon.

Fig. 677. Salvia mirzayanii.

Fig. 678. Salvia hillcoatiae.

Fig. 679. Salvia sp. A.

Fig. 680. Mentha longifolia.

Fig. 681. Zataria multiflora.

Fig. 682. Micromeria imbricata.

Fig. 683. Ziziphora tenuior.

Fig. 684. Lallemantia royleana.

Fig. 685. Lavandula macra.

Fig. 686. Lavandula subnuda.

Fig. 687. Lavandula dhofarensis subsp. dhofarensis

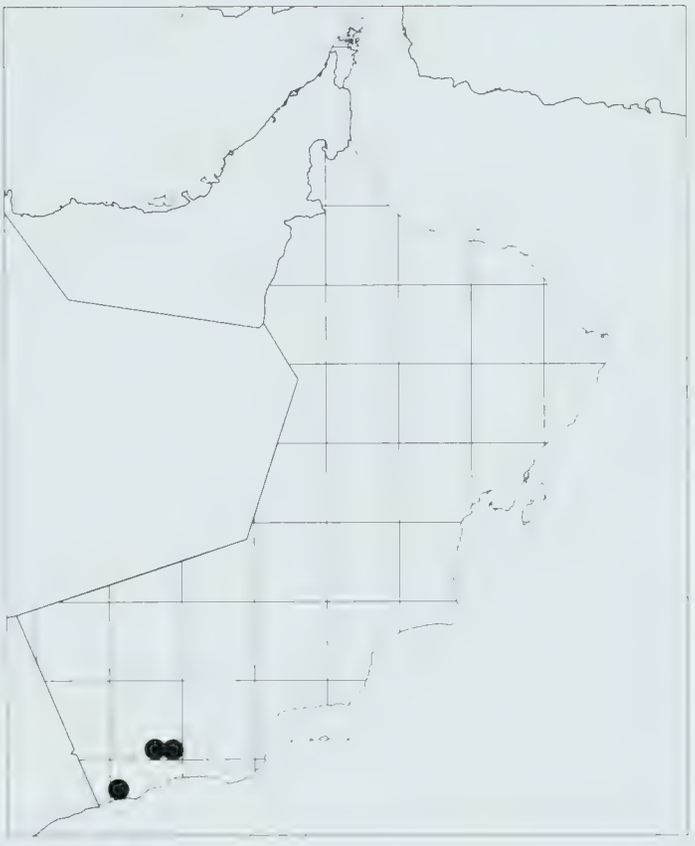

Fig. 688. Lavandula dhofarensis subsp. ayuensis

Fig. 689. Lavandula samhanensis.

Fig. 690. Salvia hasikensis.

Fig. 691. Ocimum basilicum.

Fig. 692. Ocimum forskolei.

Fig. 693. Ocimum dhofarense.

Fig. 694. Orthosiphon pallidus.

Fig. 695. Endostemon tenuiflorus.

Fig. 696. Plectranthus barbatus.

Fig. 697. Plectranthus montanus.

Fig. 698. Premna resinosa.

Fig. 699. Vitex agnus-castus.

Fig. 700. Plantago amplexicaulis.

Fig. 701. Plantago ovata var. ovata.

Fig. 702. Plantago albicans.

Fig. 703. Plantago ciliata.

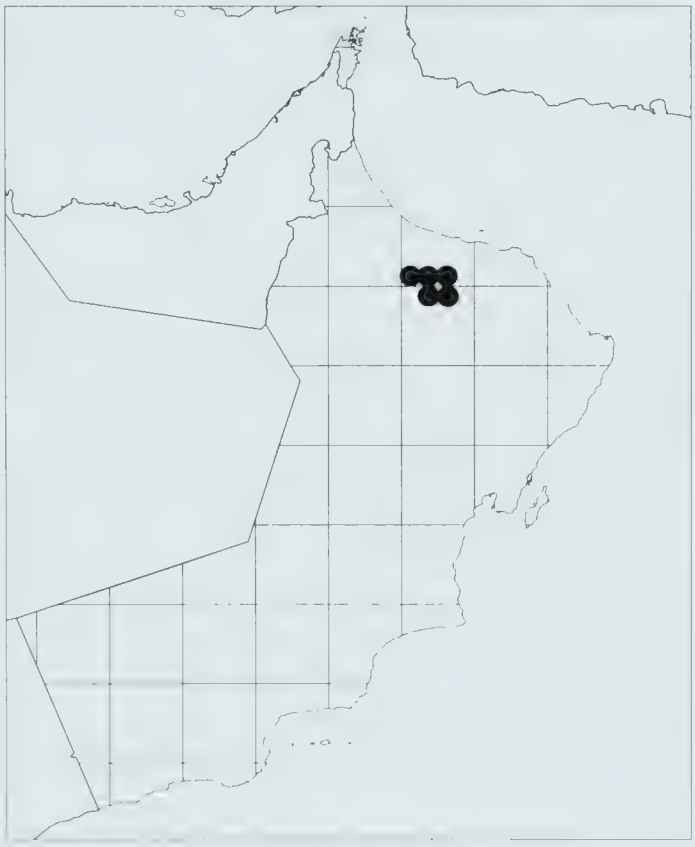

Fig. 704. Plantago major.

Fig. 705. Jasminum grandiflorum subsp. floribundum.

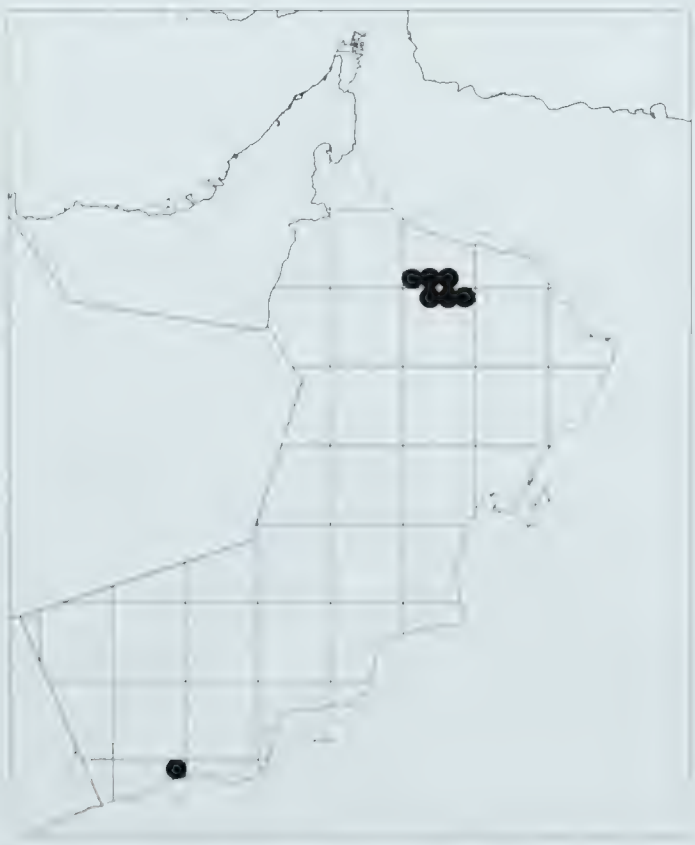

Fig. 706. Olea europaea subsp. cuspidata.

Fig. 707. Schweinfurthia papilionacea.

Fig. 708. Schweinfurthia imbricata.

Fig. 709. Schweinfurthia spinosa.

Fig. 710. ● a. Schweinfurthia pterosperma.
○ b. Schweinfurthia latifolia.

Fig. 711. Schweinfurthia pedicellata.

Fig. 712. Misopates orontium.

Fig. 713. Nanorrhinum ramosissimum.

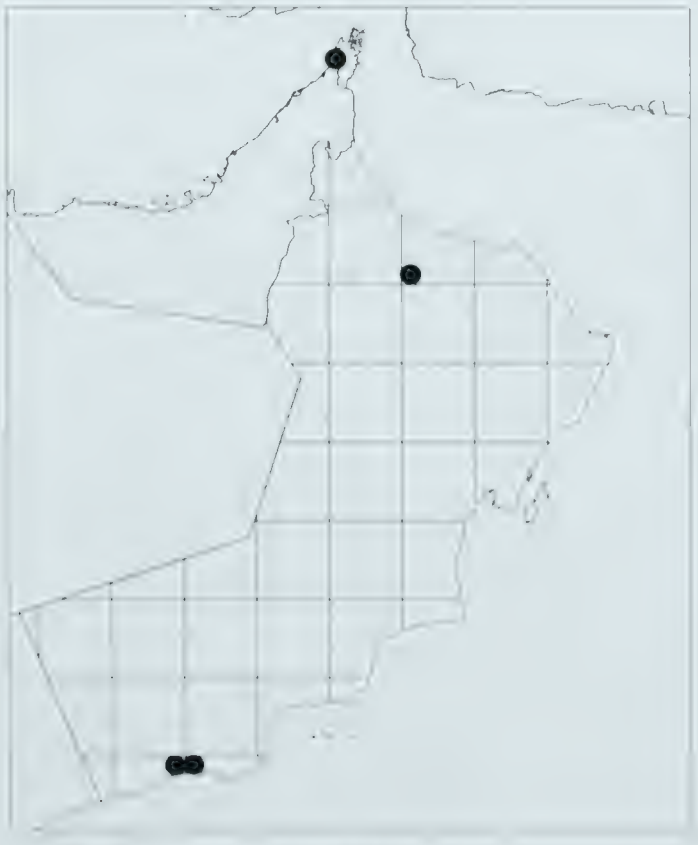

Fig. 714. Nanorrhinum hastatum.

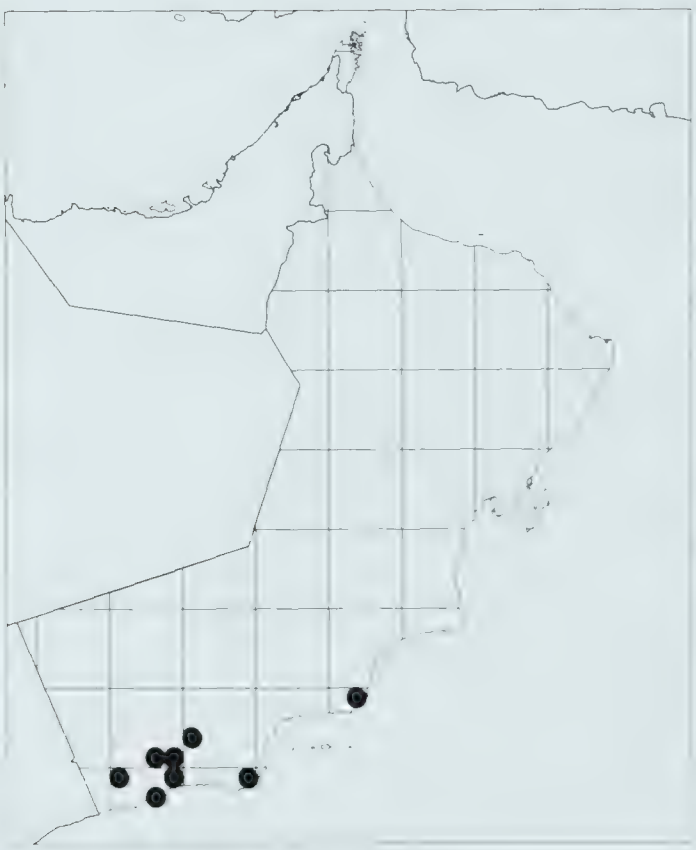

Fig. 715. Nanorrhinum heterophyllum.

Fig. 716. Linaria simplex.

Fig. 717. Verbascum sinaiticum.

Fig. 718. Verbascum omanense.

Fig. 719. Verbascum akdarense.

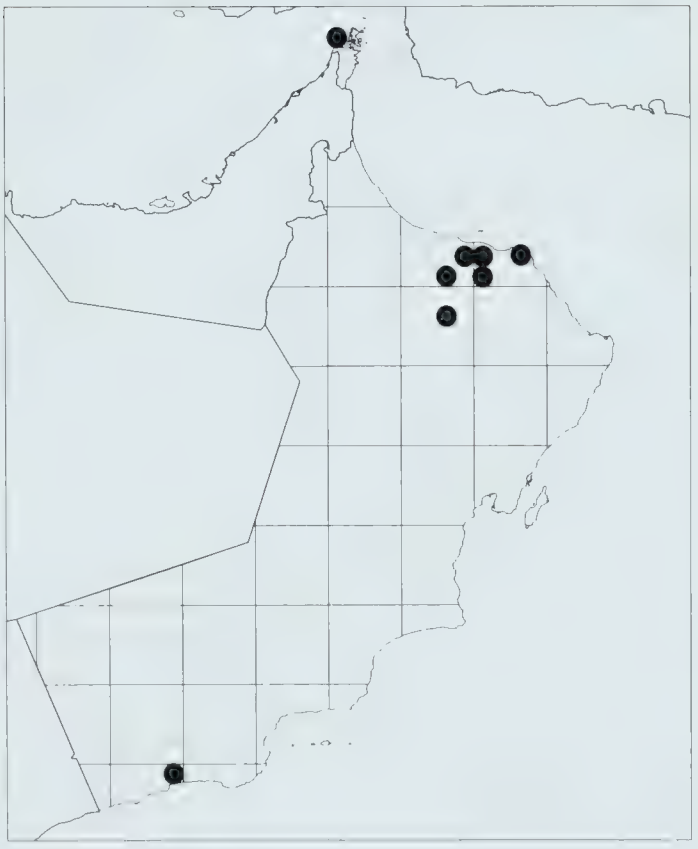

Fig. 720. Scrophularia arguta.

Fig. 721. Scrophularia desertii.

Fig. 722. Camptoloma lyperiiflorum.

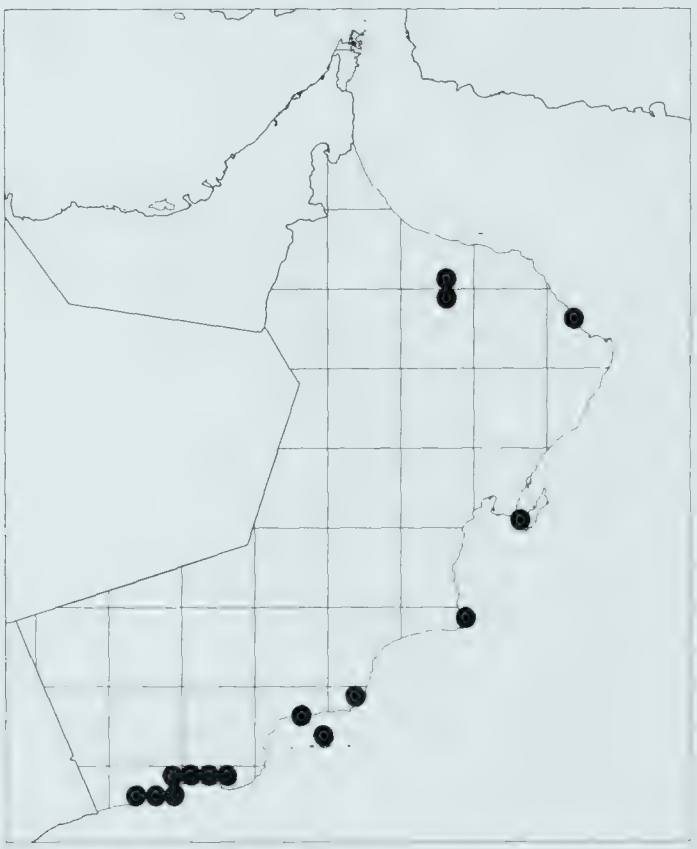

Fig. 723. Lindenbergia indica.

Fig. 724. Lindenbergia muraria.

Fig. 725. Lindenbergia arabica.

Fig. 726. Bacopa monnieri.

Fig. 727. Craterostigma pumilum.

Fig. 728. Campylanthus sedoides.

Fig. 729. Campylanthus chascaniflorus.

Fig. 730. Campylanthus antonii.

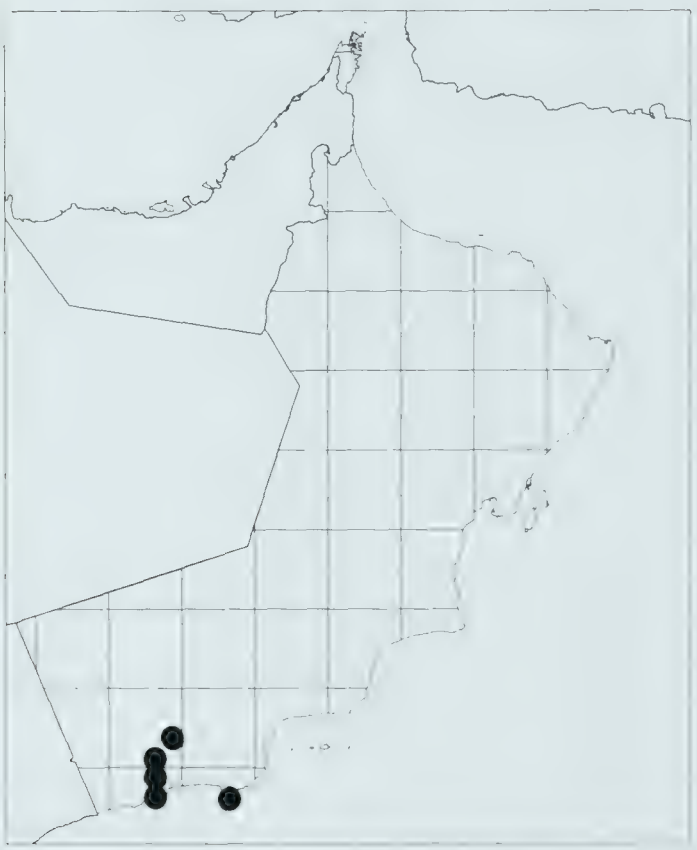

Fig. 731. Campylanthus pungens.

Fig. 732. Campylanthus mirandae.

Fig. 733. Campylanthus hajarensis.

Fig. 734. Anticharis arabica.

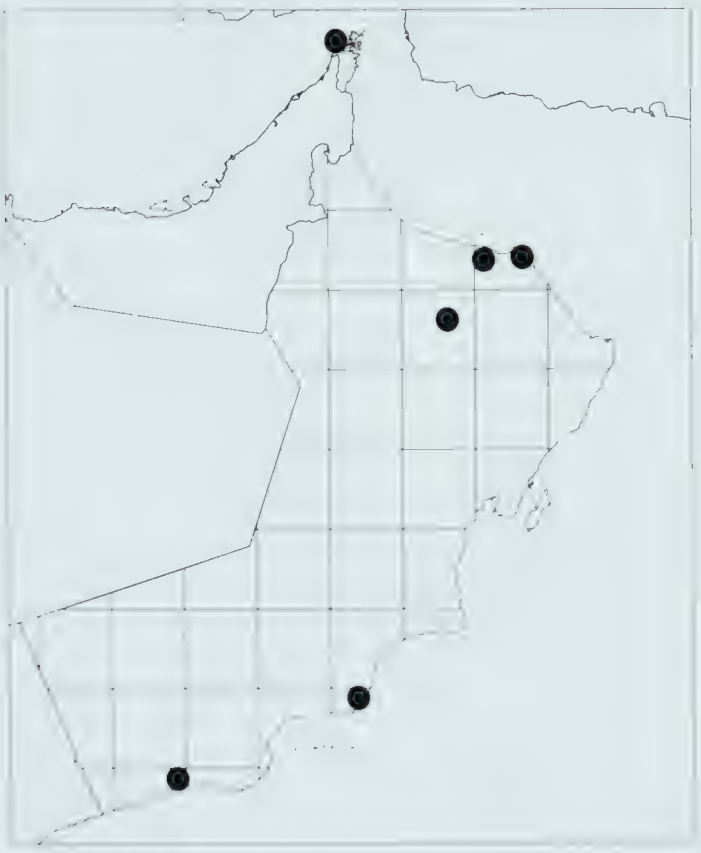

Fig. 735. Anticharis glandulosa.

Fig. 736. Veronica anagalloides subsp. anagalloides

Fig. 737. Veronica polita.

Fig. 738. Alectra parasitica.

Fig. 739. Striga gesnerioides.

Fig. 740. Striga angustifolia.

Fig. 741. Striga densiflora.

Fig. 742. Striga asiatica.

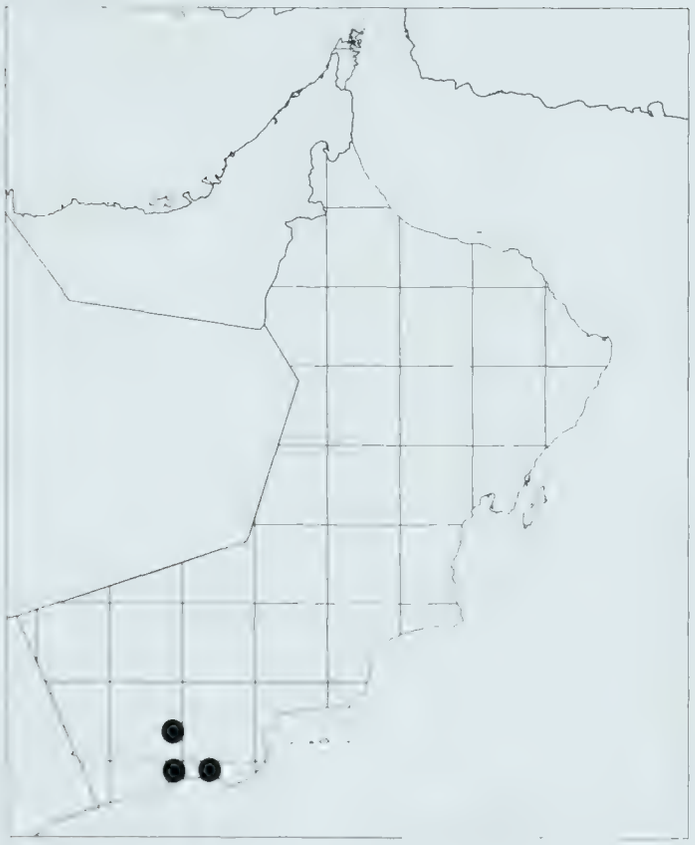

Fig. 743. Buchnera hispida.

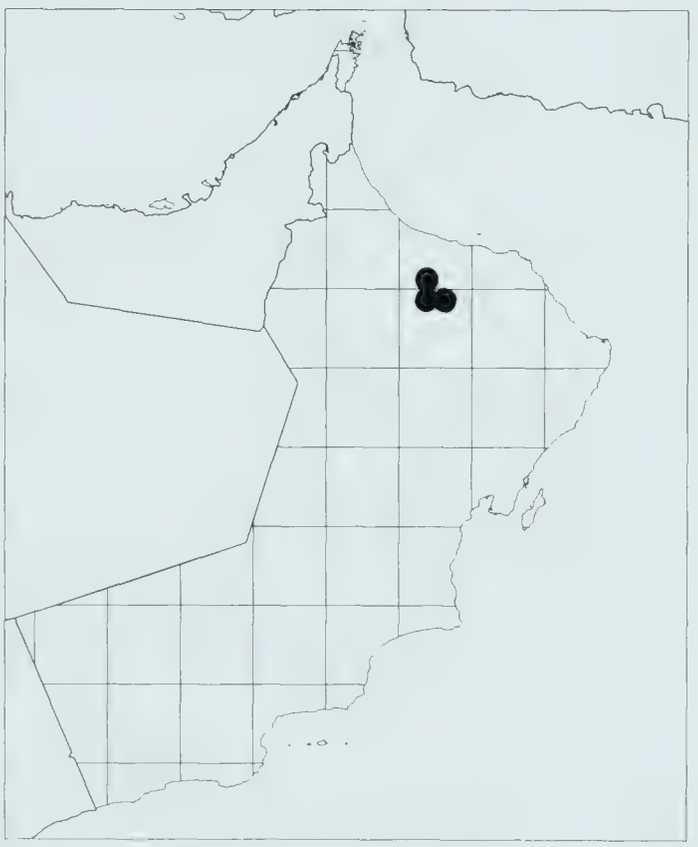

Fig. 744. Leptorhabdus parviflora.

Fig. 745. Cistanche phelypaea.

Fig. 746. Cistanche rosea.

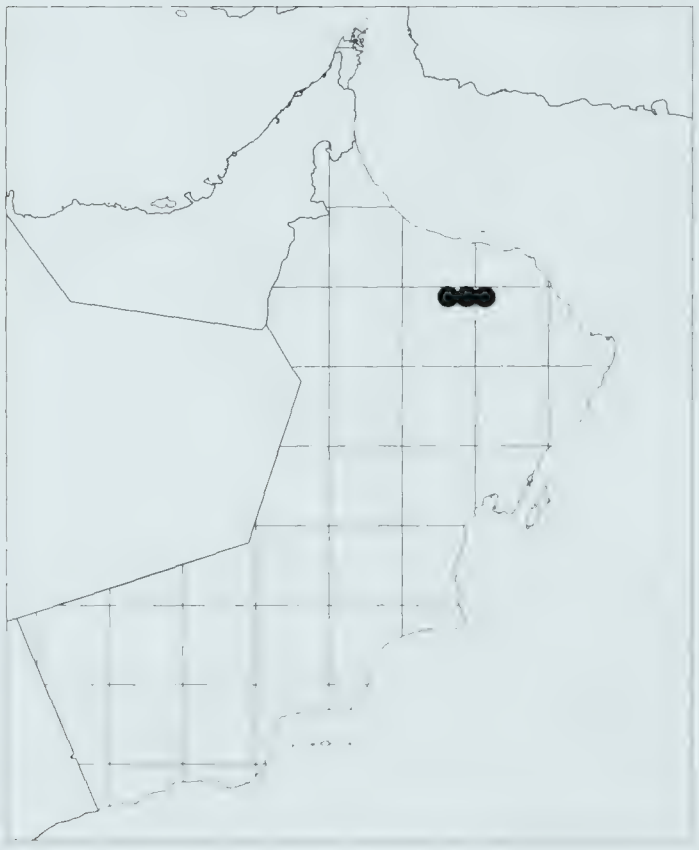

Fig. 747. Orobanche ramosa.

Fig. 748. Orobanche perangustata.

Fig. 749. Orobanche cernua.

Fig. 750. Orobanche dhofarensis.

Fig. 751. Blepharis ciliaris.

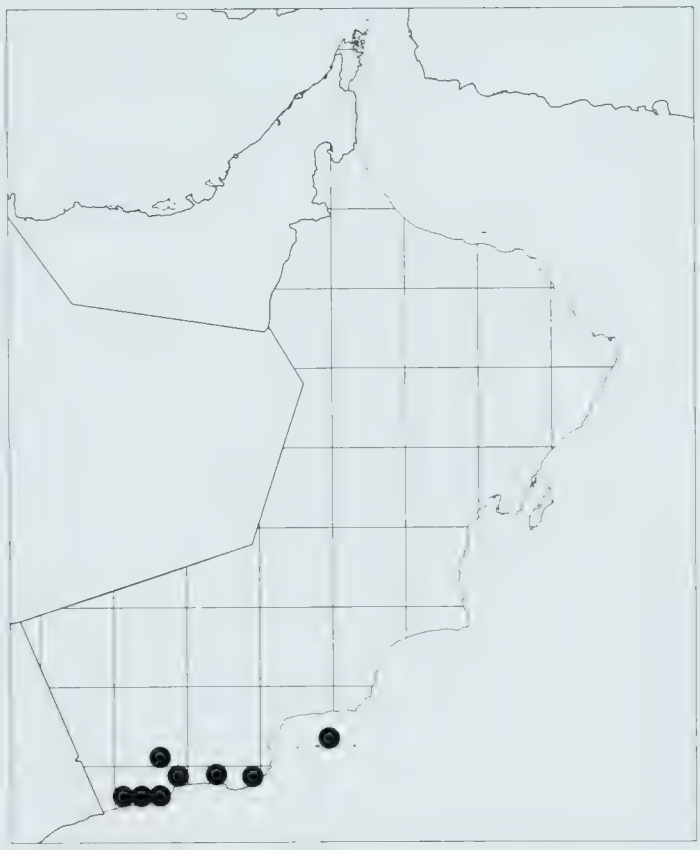

Fig. 752. Blepharis scindica.

Fig. 753. Blepharis dhofarensis.

Fig. 754. Dyschoriste dalyi.

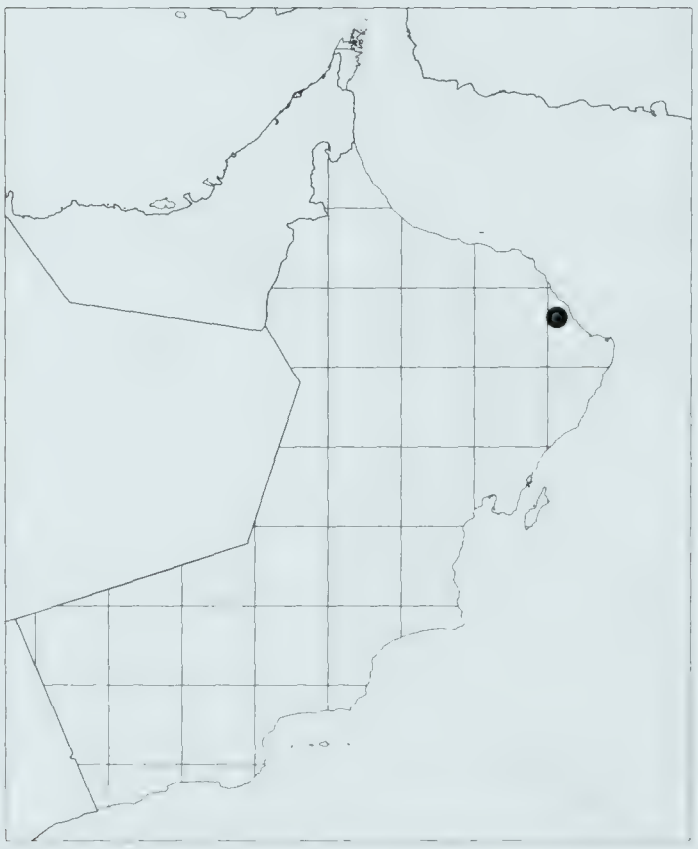

Fig. 755. Ruellia sindica.

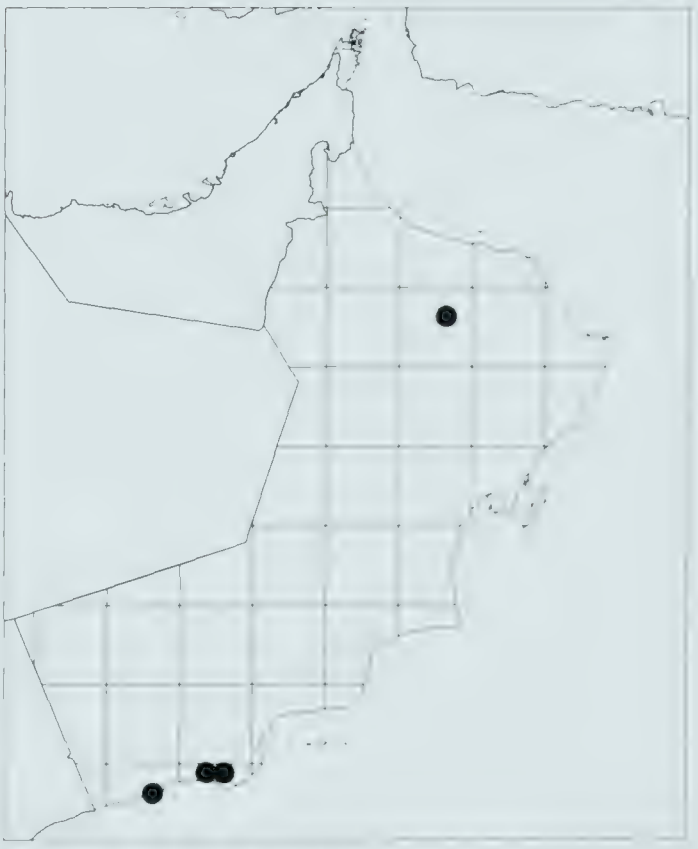

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Fig. 757. Ruellia prostrata.

Fig. 758. Ruellia discifolia.

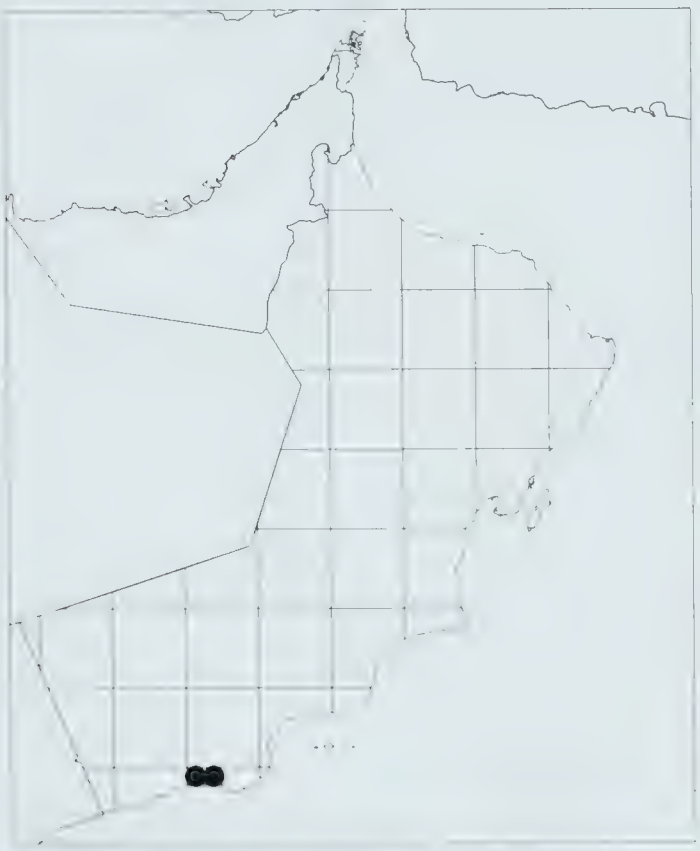


Fig. 759. Asystasia gangetica.

Fig. 760. Barleria hochstetteri.

Fig. 761. Barleria argentea.

Fig. 762. Barleria acanthoides.

Fig. 763. Barleria candida.

Fig. 764. Barleria proxima.

Fig. 765. Barleria samhanensis.

Fig. 766. Barleria sp. A

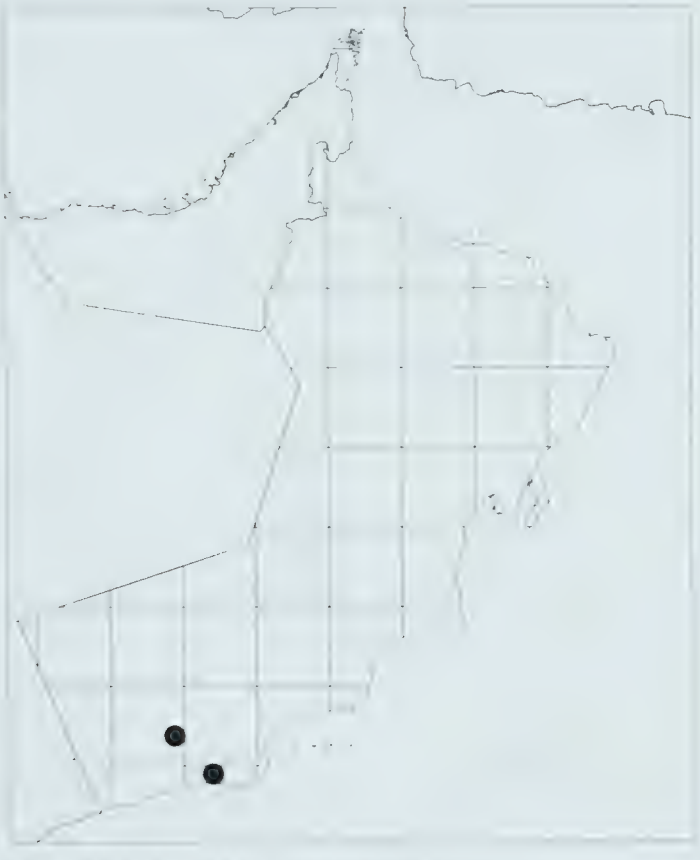


Fig. 767. Lepidagathis calycina.

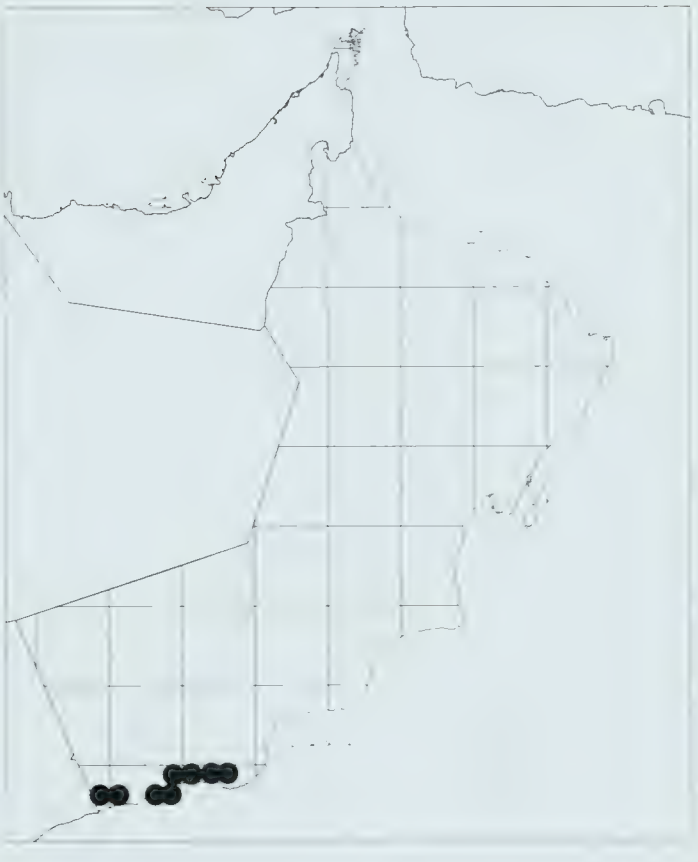


Fig. 768. Neuracanthus robecchii subsp. atratus.

Fig. 769. Neuracanthus spinosus.

Fig. 770. Dicliptera paniculata.

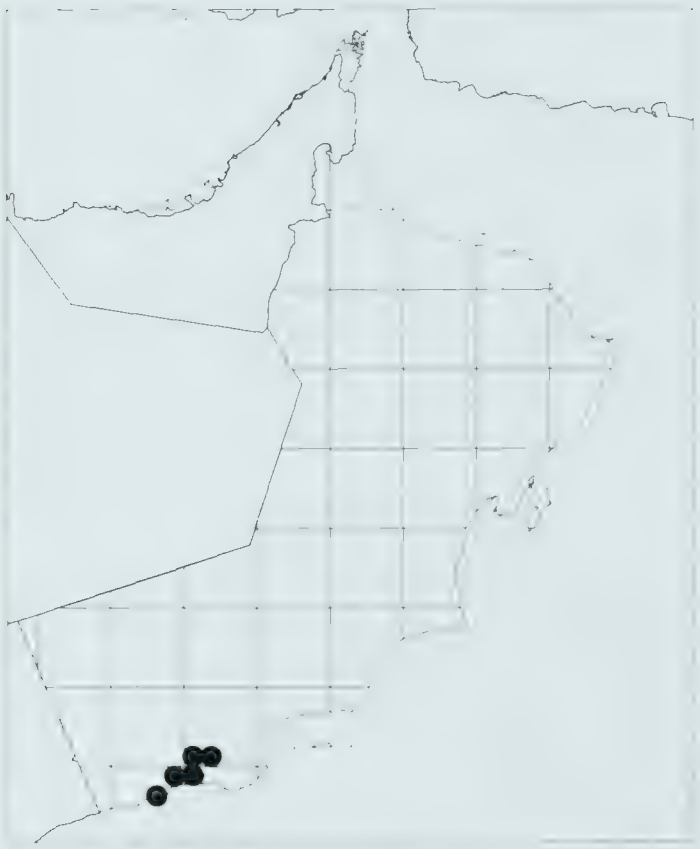


Fig. 771. Hypoestes forsskaolii.

Fig. 772. Ruttya fruticosa.

Fig. 773. Ecbolium viride.

Fig. 774. Megalochlamys violacea.

Fig. 775. Justicia areysiana.

Fig. 776. Justicia diffusa.

Fig. 777. Justicia heterocarpa.

Fig. 778. Justicia odora.

Fig. 779. Justicia debilis.

Fig. 780. Justicia parviflora.

Fig. 781. Sesamum indicum.

Fig. 782. Tecomella undulata.

Fig. 783. Utricularia australis.

Fig. 784. Utricularia striatula.

Fig. 785. Wahlenbergia flexuosa.

Fig. 786. Campanula erinus.

Fig. 787. Campanula akhdarensis.

Fig. 788. Lobelia heyneana.

Fig. 789. Oldenlandia corymbosa var. corymbosa.

Fig. 790. Oldenlandia corymbosa var. caespitosa.

Fig. 791. Kohautia caespitosa.

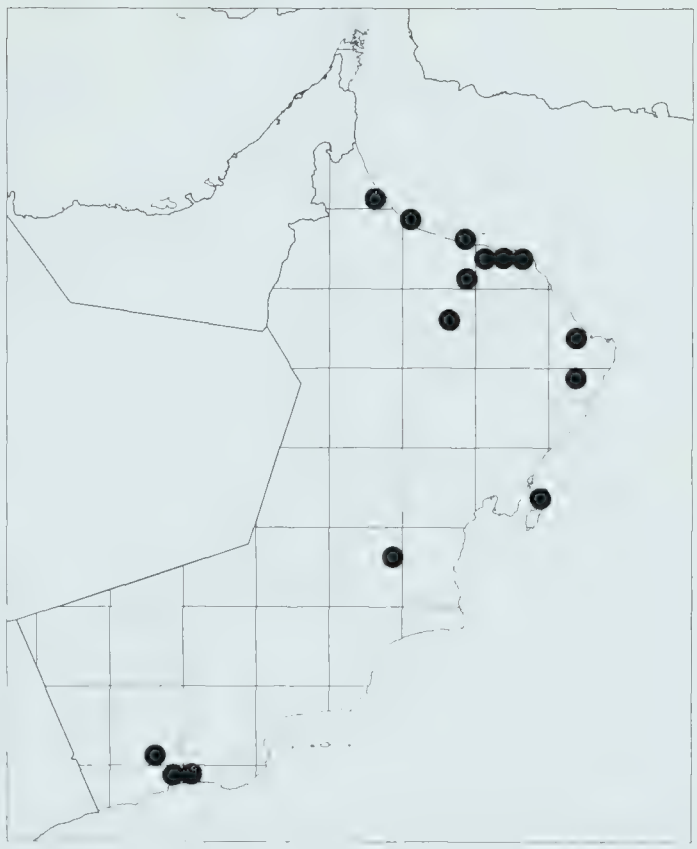


Fig. 792. Kohautia retrorsa.

Fig. 793. Callipeltis cucullaris.

Fig. 794. Rubia infundibularis.

Fig. 795. Galium decaisnei.

Fig. 796. Galium ceratopodium.

Fig. 797. Galium aparine.

Fig. 798. Valentia hispida.

Fig. 799. Plocama aucheri.

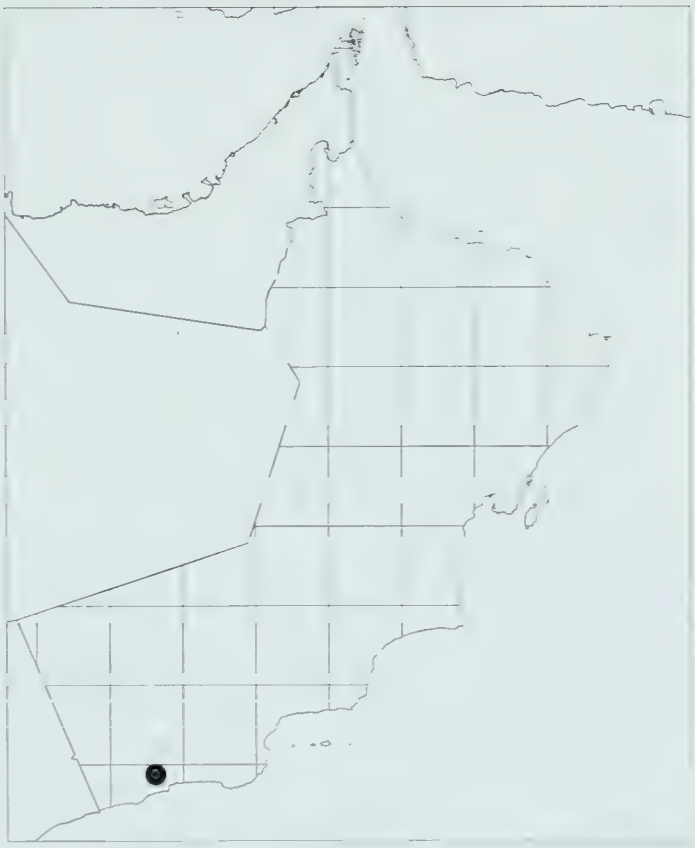


Fig. 800. Plocama yemenensis.

Fig. 801. Plocama calycoptera.

Fig. 802. Plocama hymenostephana.

Fig. 803. Pavetta longiflora.

Fig. 804. Lonicera hypoleuca.

Fig. 805. Scabiosa olivieri.

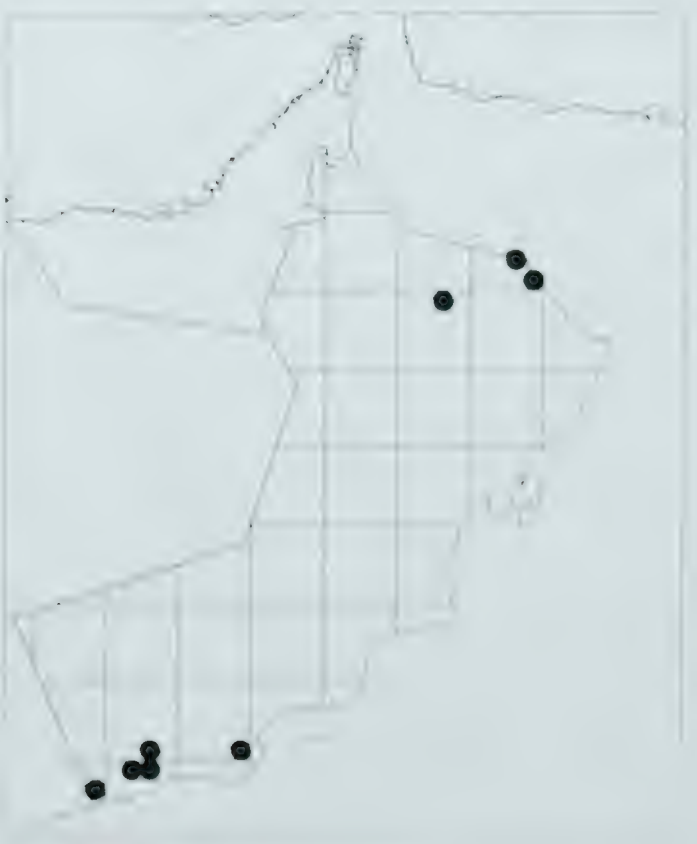


Fig. 806. Dicoma schimperi.

Fig. 807. Atractylis cancellata.

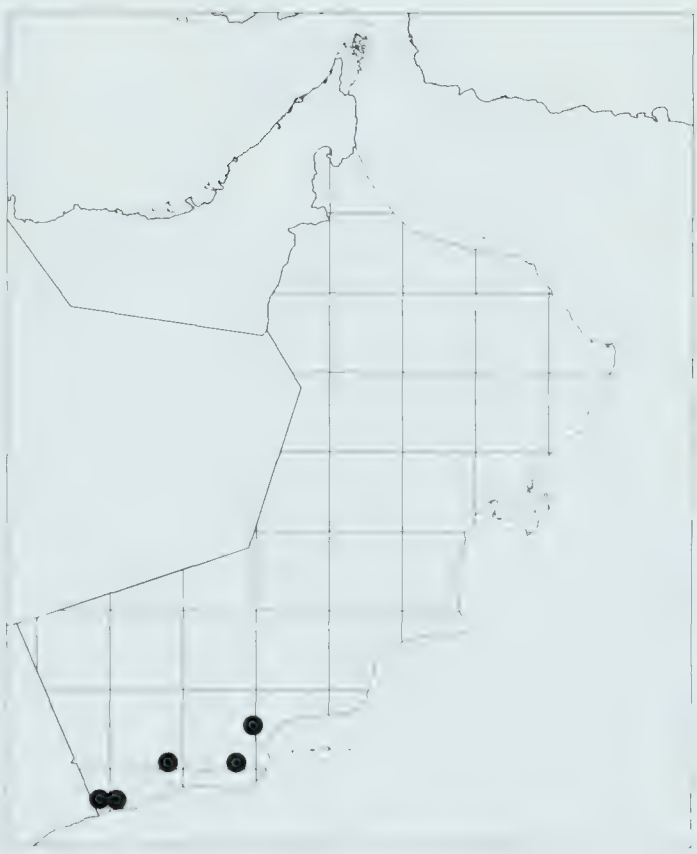


Fig. 808. Atractylis kentrophylloides.

Fig. 809. Carduus pycnocephalus.

Fig. 810. Carthamus tinctorius.

Fig. 811. Centaurea dhofarica.

Fig. 812. Centaurea pseudosinaica subsp. pseudoisinaica.

Fig. 813. Centaurea pseudosinaica subsp. niebuhrii.

Fig. 814. Centaurea wendelboi.

Fig. 815. Echinops atrox.

Fig. 816. Echinops erinaceus.

Fig. 817. Jurinea berardioides.

Fig. 818. Jurinea carduiformis.

Fig. 819. Notobasis syriaca.

Fig. 820. Volutaria dhofarica.

Fig. 821. Volutaria sinaica

Fig. 822. Zoegea purpurea.

Fig. 823. Cichorium intybus.

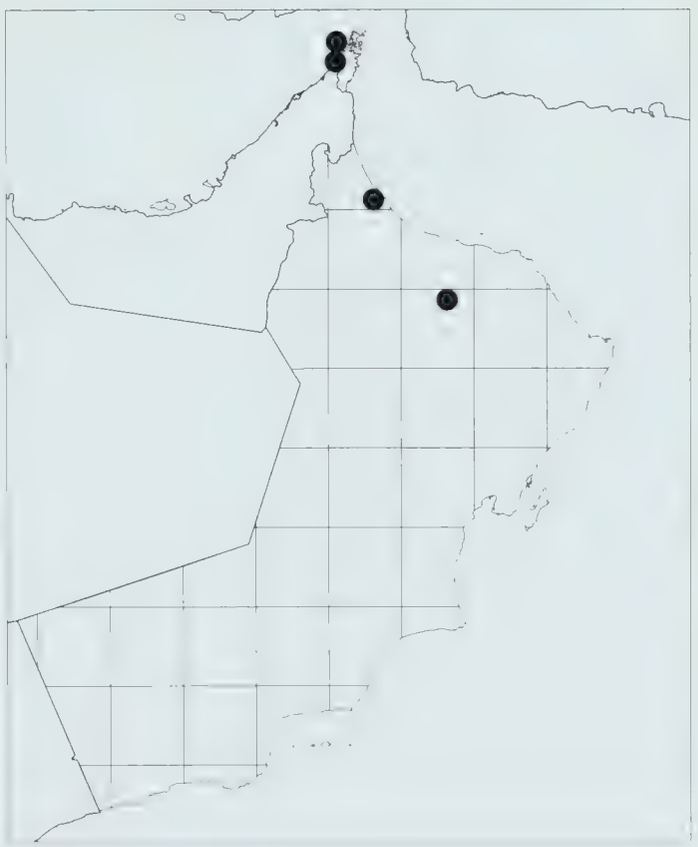


Fig. 824. Crepis kotschyana.

Fig. 825. Garhadiolus hedypnois.

Fig. 826. Koelpinia linearis.

Fig. 827. Lactuca dissecta.

Fig. 828. Lactuca inermis.

Fig. 829. Lactuca orientalis.

Fig. 830. Launaea almahrahensis.

Fig. 831. Launaea bornmuelleri.

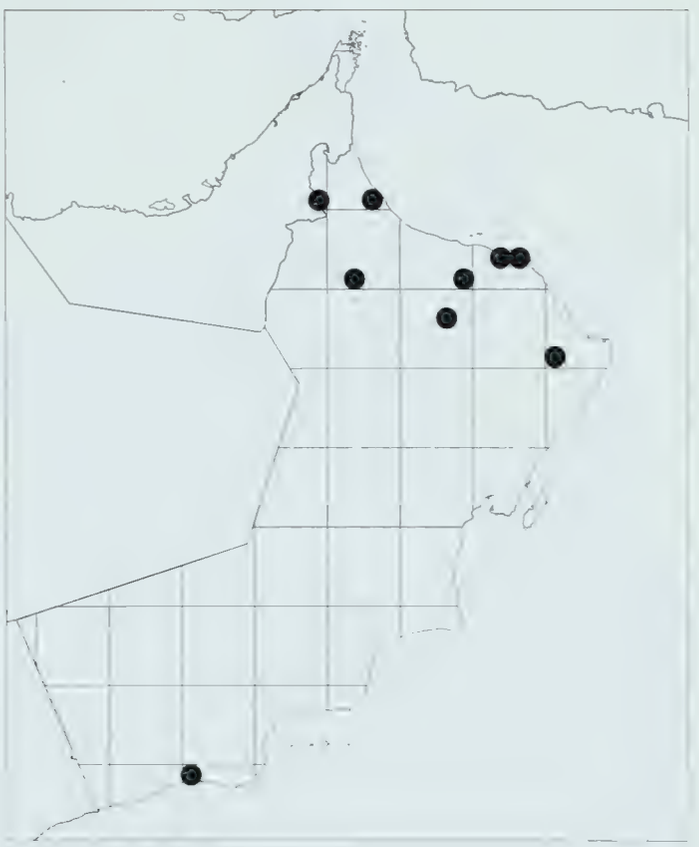


Fig. 832. Launaea capitata.

Fig. 833. Launaea castanosperma.

Fig. 834. Launaea crassifolia.

Fig. 835. Launaea hafunensis.

Fig. 836. Launaea intybacea.

Fig. 837. Launaea massavensis.

Fig. 838. Launaea mucronata subsp. mucronata.

Fig. 839. Launaea mucronata subsp. cassiniana.

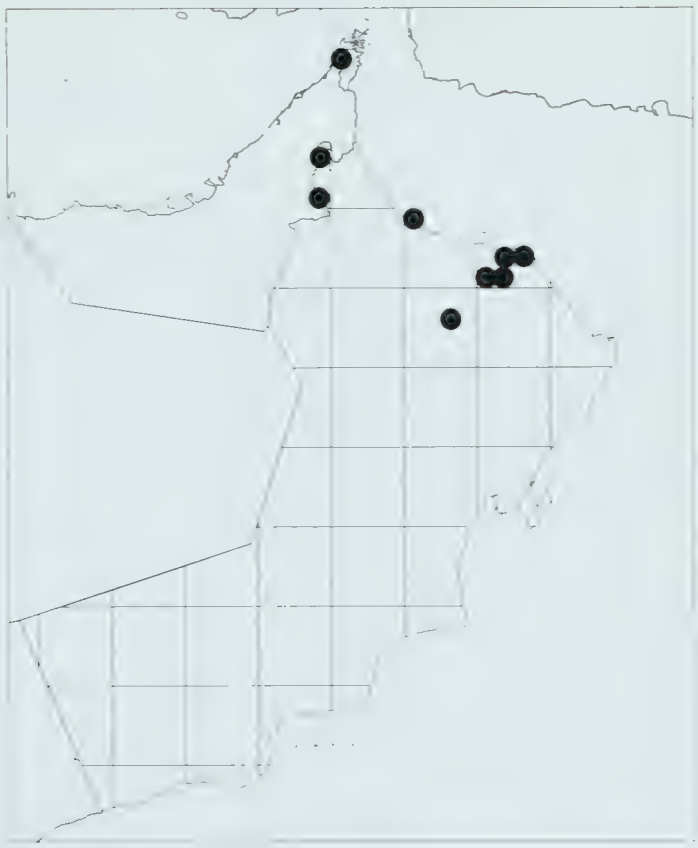


Fig. 840. Launaea omanensis.

Fig. 841. Launaea procumbens.

Fig. 842. Reichardia tingitana.

Fig. 843. Sonchus maritimus.

Fig. 844. Sonchus oleraceus.

Fig. 845. Urospermum picroides.

Fig. 846. Vernonia arabica.

Fig. 847. Vernonia cinerascens.

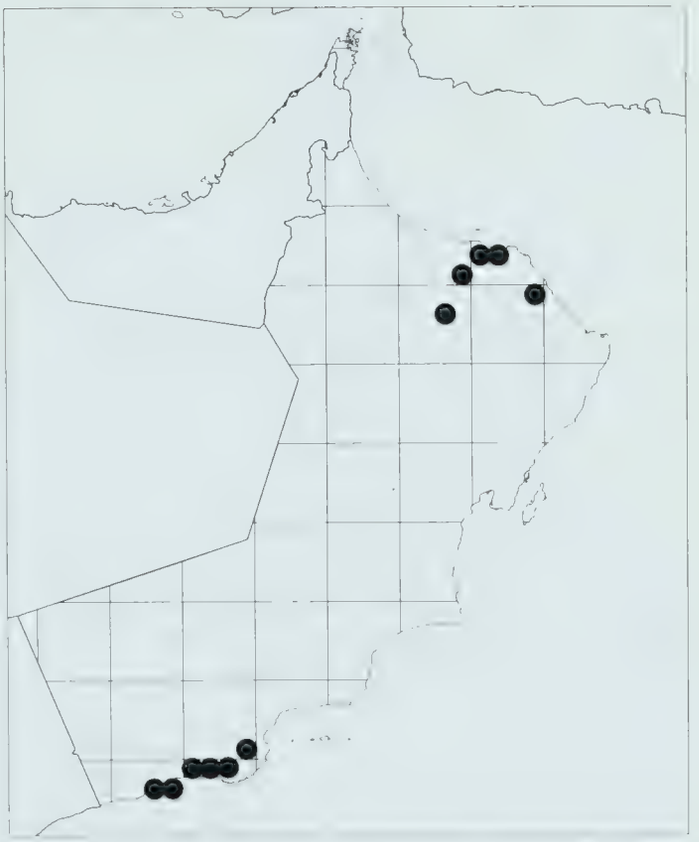


Fig. 848. Vernonia cinerea.

Fig. 849. Euryops arabicus.

Fig. 850. Kleinia mccoyi.

Fig. 851. Kleinia odora.

Fig. 852. Kleinia saginata.

Fig. 852. Senecio breviflorus.

Fig. 853. Senecio glaucus subsp. coronopifolius.

Fig. 855. Calendula arvensis.

Fig. 856. Tripteris vaillantii.

Fig. 857. Cymbolaena griffithii.

Fig. 858. Filago desertorum.

Fig. 859. Filago pyramidata.

Fig. 860. Filago abyssinica.

Fig. 861. Helichrysum glumaceum.

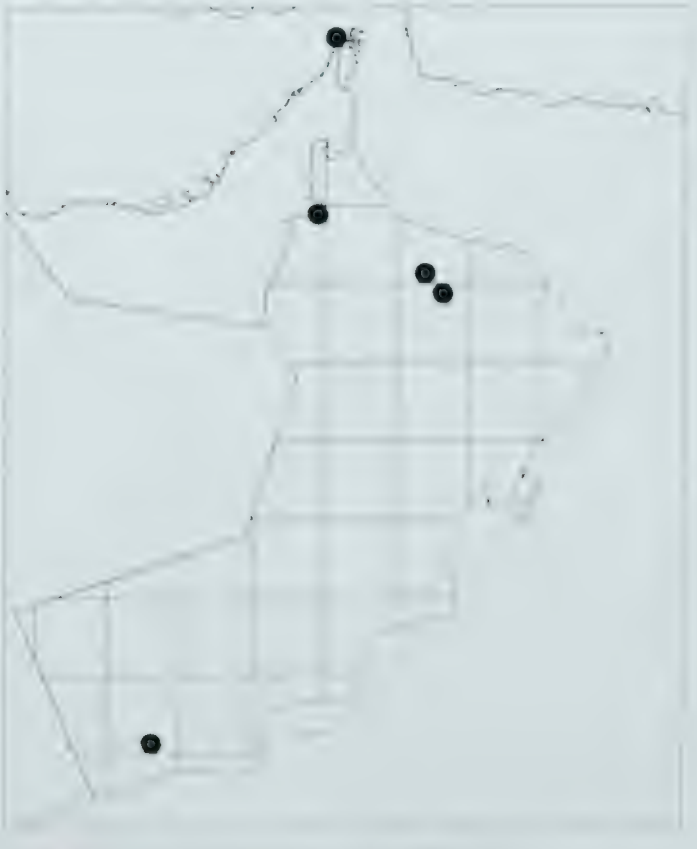


Fig. 862. Helichrysum luteoalbum.

Fig. 863. Helichrysum somalense.

Fig. 864. Ifloga spicata.

Fig. 865. Lasiopogon muscoides.

Fig. 866. Phagnalon schweinfurthii.

Fig. 867. Erigeron bonariensis.

Fig. 868. Erigeron trilobus.

Fig. 869. Psiadia punctulata.

Fig. 870. Anthemis odontostephana.

Fig. 871. Artemisia sieberi.

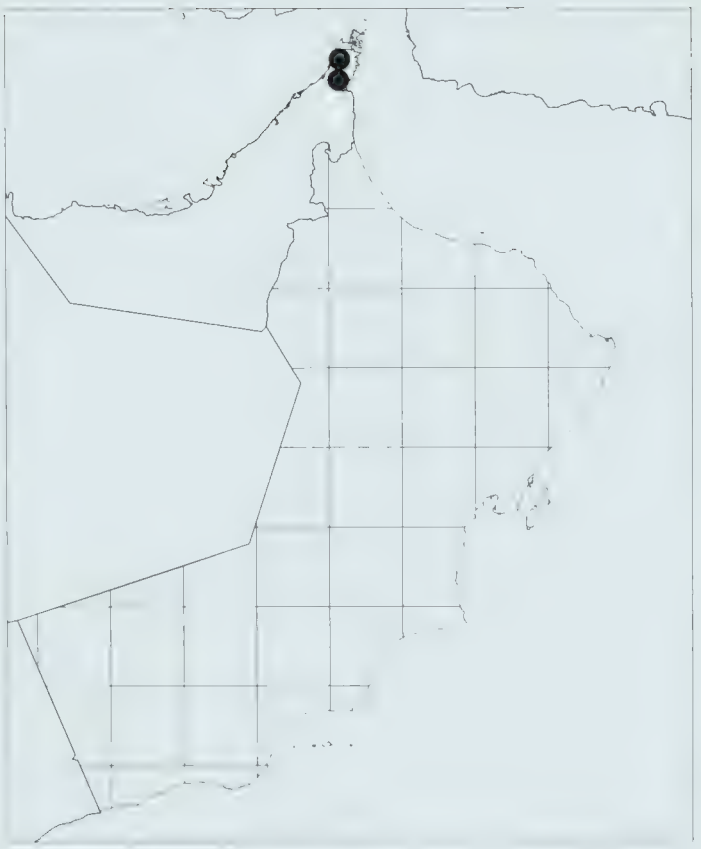


Fig. 872. Matricaria aurea.

Fig. 873. Blumea lacera.

Fig. 874. Blumea axillaris.

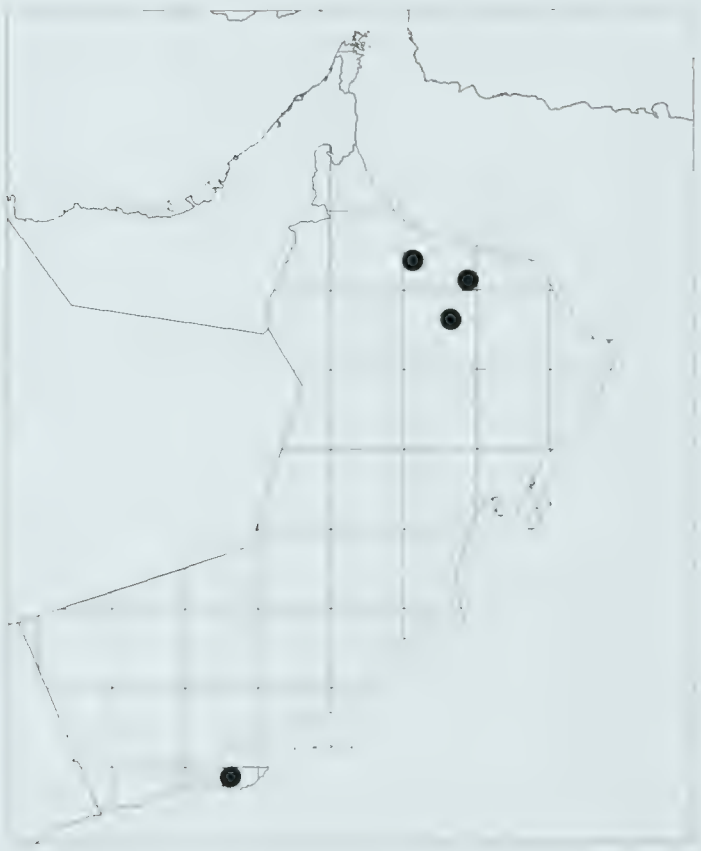


Fig. 875. Doellia bovei.

Fig. 876. Iphiona aucheri.

Fig. 877. Iphiona horrida.

Fig. 878. Iphiona scabra.

Fig. 879. Iphiona senecionoides.

Fig. 880. Pallenis hierichuntica.

Fig. 881. Pegolettia senegalensis.

Fig. 882. Pentanema divaricatum.

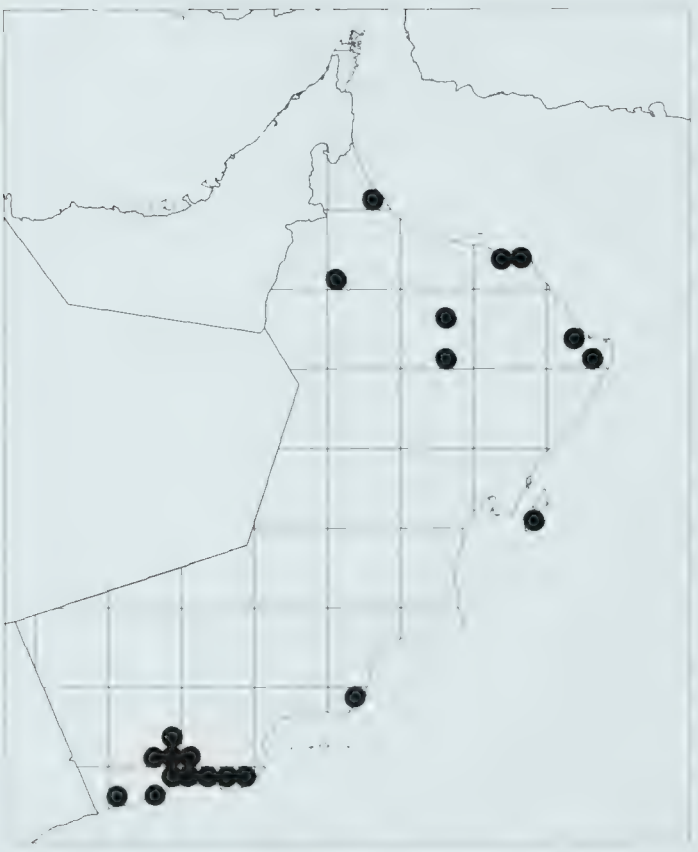


Fig. 883. Pluchea arabica.

Fig. 884. Pluchea dioscoridis.

Fig. 885. Pluchea ovalis.

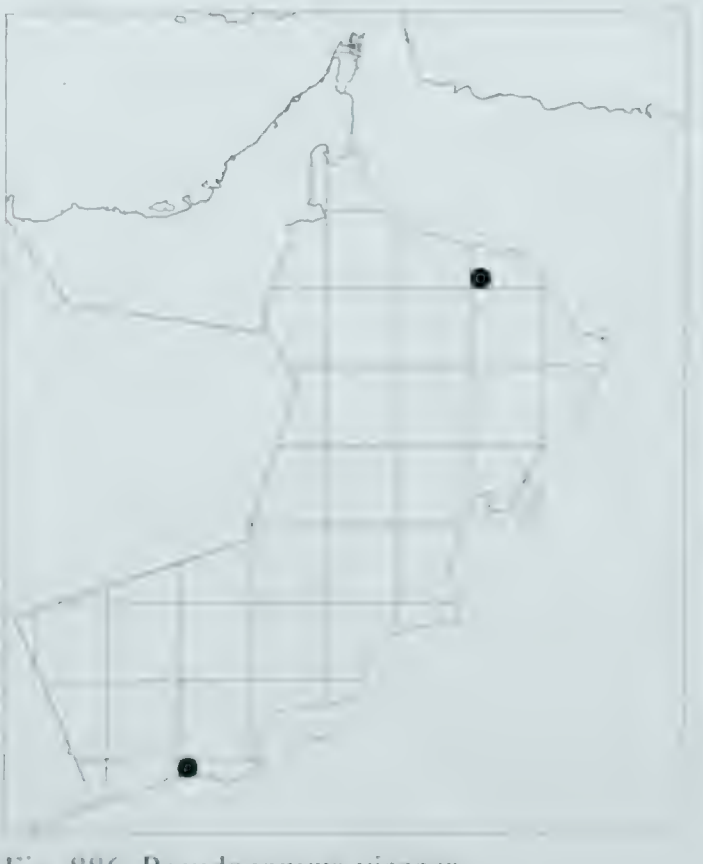


Fig. 886. Pseudoconyza viscosa.

Fig. 887. Pulicaria arabica.

Fig. 888. Pulicaria argyrophylla subsp. argyrophylla.

Fig. 889. Pulicaria edmondsonii.

Fig. 890. Pulicaria glutinosa subsp. glutinosa.

Fig. 891. Pulicaria jaubertii.

Fig. 892. Pulicaria nobilis.

Fig. 893. Pulicaria omanensis.

Fig. 894. Pulicaria pulvinata.

Fig. 895. Pulicaria samhanensis.

Fig. 896. Pulicaria schimperi.

Fig. 897. Pulicaria undulata subsp. undulata.

Fig. 898. Rhanterium epapposum.

Fig. 899. Blepharispermum hirtum.

Fig. 900. Ageratum conyzoides.

Fig. 901. Flaveria trinervia.

Fig. 902. Tagetes erecta.

Fig. 903. Thymophylla tenuiloba.

Fig. 904. Acanthospermum hispidum.

Fig. 905. Bidens biternata.

Fig. 906. Bidens pilosa.

Fig. 907. Blainvillea acmella.

Fig. 908. Eclipta prostrata.

Fig. 909. Parthenium hysterophorus.

Fig. 910. Sclerocarpus africanus.

Index of Latin and vernacular names

A

abu 'ain safra, 263
Acanthaceae, 161
Acanthospermum, 273
Acanthospermum hispidum, 273
Achyrocline glumacea, 245
Achyrocline luzuloides, 245
Achyrocline pumilum, 246
ada an, 164
adan, 8
adana, 8
Adenium, 8
Adenium obesum, 8
adfir, 9
adheed, 233
Aegopordon berardioides, 216
Ageratum, 271
Ageratum conyzoides, 271
ailamat, 252
ain el baqr, 241
Alectra, 153
Alectra parasitica, 153
alib, 165
al-layg, 58
al-layq, 58
al mabarqashah, 216
al-olleygah, 58
Amberboa leucantha, 218
Amberboa lippii auct, 218
Amberboa sinaica, 218
amraar, 213
Anarrhinum pedicellatum, 137
anbr, 218
Anchusa hispida, 94
Anchusa hispidissima, 90
Anchusa spinocarpos, 87
Angolluma, 35
Angolluma luntii, 36
anhm, 239
Anomalluma, 34
Anomalluma mccoyi, 34
Anonymos petiolata, 1
Anthemis, 251
Anthemis gayana, 252
Anthemis odontostephana, 252
Anthjemis gayana var. *multiramosa*, 252
Anticharis, 151
Anticharis arabica, 151
Anticharis glandulosa, 152
Antirrhinum heterophyllum, 139
Antirrhinum orontium, 137
Antirrhinum papilionaceum, 134
Antirrhinum pterospermum, 136
Antirrhinum simplex, 140
Antura, 11
Anvillea garcinii, 278
Apocynaceae, 5
Apocynoideae, 8
arfaj, 269
Arnebia, 90
Arnebia hispidissima, 90
arshad, 126
Artemisia, 252
Artemisia herba-alba, 252
var. *laxiflora*, 252
Artemisia sieberi, 252
Asclepiadoideae, 14
Asclepias cordata, 17
Asclepias daemia, 18
Asclepias fruticosa, 16
Asclepias nivea, 19
Asclepias procera, 15
Asclepias setosa, 16
Asclepias stipitacea, 21
asebis, 197
ashkar, 15
asi, 64
asiyes, 197
asiyot, 64
asker, 164
Asperugo, 89
Asperugo procumbens, 89
Asteraceae, 201
Asteriscus arabicus, 269
Asteriscus hierichunticus, 258
Asteriscus pygmaeus, 258
Asystasia, 169
Asystasia coromandeliana, 169
var. *micrantha*, 169
Asystasia gangetica, 169
subsp. ***micrantha***, 169
atheed, 229
Atractylis, 209
Atractylis arabica, 211
Atractylis cancellata, 210
Atractylis kentrophylloides, 210
Atractylis yemensis, 210
Atropa physalodes, 45
Avicennia, 99
Avicennia marina, 99
Avicenniaceae, 99
awteeb, 260
awzak, 38
aylob, 165
ayzob, 165

B

babunaj, 253
Baccharis dioscoridis, 261
Baccharis ovalis, 261
Bacopa, 147
Bacopa monnieri, 147
bambar, 72

baqrw, 231
Barkhausia kotschyana, 220
Barleria, 170
Barleria acanthoides, 171
Barleria almughsaylensis, 174
Barleria argentea, 171
Barleria aucheriana, 170
Barleria candida, 172
Barleria diffusa, 171
Barleria hochstetteri, 170
Barleria proxima, 172
Barleria samhanensis, 173
Barleria sp. ***A***, 174
barnouf, 261
batingan, 48
Becium dhofarense, 122
benj, 44, 46
Bentia fruticulosa, 179
Bidens, 274
Bidens biternata, 274
Bidens chinensis, 274
Bidens pilosa, 274
bidol, 21
Bignonia glauca, 183
Bignonia undulata, 183
Bignoniaceae, 183
bithman, 109
black nightshade, 39
Blainvillea, 275
Blainvillea acmella, 275
Blainvillea dichotoma, 275
Blainvillea gayana, 275
Blainvillea rhomboidea, 275
Blepharis, 163
Blepharis ciliaris, 163
Blepharis dhofarensis, 165
Blepharis edulis, 164
Blepharis linariifolia, 164
Blepharis scindica, 164
Blepharispermum, 270
Blepharispermum hirtum, 270
Blumea, 254
Blumea aurita, 262
Blumea axillaris, 254
Blumea bovei, 255
Blumea lacera, 254
Blumea mollis, 254
Blumea viscosa, 262
Boraginaceae, 67
Boraginoideae, 68
Borago africana, 91
Borago arabica, 92
Borago verrucosa, 91
Boucerosia acutangla, 29
Boucerosia adenensis, 25
Boucerosia arabica, 26
Boucerosia awdeliana, 30
Boucerosia edulis, 24
Boucerosia penicillata, 29
Boucerosia quadrangula, 31
Boucerosia russeliana, 29
Boucerosia stocksiana, 24
Bouchea sessilifolium, 96
brayhoo, 108
Breweria latifolia, 51
brinjal, 48
Buchnera, 156
Buchnera angustifolia, 155
Buchnera asiatica, 156
Buchnera densiflora, 155
Buchnera gesnerioides, 154
Buchnera hispida, 156
Buglossoides tenuiflora, 95

C

Calendula, 241
Calendula arvensis, 241
Callipeltis, 192
Callipeltis cucullaris, 192
forma *aperta*, 192
Calotropis, 15
Calotropis procera, 15
Campanula, 187
Campanula akhdarensis, 187
Campanula erinus, 187
Campanulaceae, 186
Camptoloma, 144
Camptoloma lyperiiflorum, 144
Camptoloma villosa, 144
Campylanthus, 148
Campylanthus antonii, 149
Campylanthus chascaniflorus, 149
Campylanthus hajarensis, 151
Campylanthus mirandae, 150
Campylanthus pungens, 150
Campylanthus sedoides, 148
Canscora, 4
Canscora concanensis, 4
Caprifoliaceae, 198
Capsicum annum, 48
Caralluma adenensis, 25
Caralluma arabica, 26
Caralluma awdeliana, 30
Caralluma edulis, 24
Caralluma flava, 27
Caralluma foulcheri-delboscii, 32
Caralluma hexagona, 32
Caralluma kalmbacheriana, 25
Caralluma luntii, 36
Caralluma penicillata, 29
Caralluma quadrangula, 31
Caralluma rauhii, 25
Caralluma retrospiciens, 29
subsp. *tombuctuensis*, 29
var. *acutanganla*, 29
Caralluma russeliana, 29
Caralluma scutellata, 33
Caralluma shadbhana, 32
Carduncellus kentrophylloides, 210
Carduus, 211
Carduus arabicus, 211
Carduus australis, 211
Carduus pycnocephalus, 211
Carduus syriacus, 217
Carissa, 10
Carissa edulis, 11
Carissa spinarum, 11
Carthamus, 211
Carthamus oxycanthus, 212
Carthamus tinctorius, 212
Catharanthus roseus, 11
Caudanthera, 24

Caudanthera edulis, 24
Celsia akdarensis, 143
Centaurea, 212
Centaurea dhofarica, 213
Centaurea pseudosinaica, 213
subsp. ***niebuhrii***, 214
subsp. ***pseudosinaica***, 213
Centaurea solstitialis, 213
Centaurea wendelboi, 214
Centaurium, 4
Centaurium pulchellum, 4
Cephalostigma flexuosum, 186
Ceropegia, 22
Ceropegia botrys, 23
Ceropegia bulbosa, 22
Ceropegia mansuriana, 23
Ceropegia vignaldiana, 22
Charachera viburnoides, 97
Chascanum, 95
Chascanum sessilifolium, 96
chasteberry, 126
chaste tree, 126
Chondrilla capitata, 226
Chrysocoma spicata, 247
Cibirhiza, 14
Cibirhiza dhofarensis, 14
Cichorium, 219
Cichorium intybus, 220
Cistanche, 158
Cistanche phelypaea, 158
Cistanche rosea, 159
Cistanche tinctoria, 158
Cistanche tubulosa, 158
Coleus, 124
Coleus barbatus, 124
Compositae, 201
Convolvulaceae, 48
Convolvulus, 53
Convolvulus acanthocladus, 53
Convolvulus arabicus, 56
Convolvulus arvensis, 58
Convolvulus buschiricus, 57
Convolvulus cairicus, 64
Convolvulus cephalopodus, 57
Convolvulus desertii, 56
Convolvulus dissectus, 60
Convolvulus fatmensis, 58
Convolvulus glomeratus, 56
Convolvulus hadramauticus, 59
Convolvulus hastatus, 58
Convolvulus hystrix, 55
Convolvulus mascatensis, 55
Convolvulus microphyllus, 56
Convolvulus nil, 61
Convolvulus obscurus, 62
Convolvulus oppositifolia, 58
Convolvulus pes-caprae, 63
Convolvulus prostratus, 56
Convolvulus sinensis, 61
Convolvulus somalensis, 59
Convolvulus ulicinus, 54
Convolvulus virgatus, 55
var. *subaphyllus*, 55
Conyza axillaris, 254
Conyza bonariensis, 250
Conyza bovei, 255
Conyza cinerea, 236
Conyza dioscoridis, 261
Conyza lacera, 254
Conyza linifolia, 250
Conyza pinnatifida, 250
Conyza stricta, 250
var. *pinnatifida*, 250
Conyza triloba, 250
Conyza viscosa, 262
Coptosperma graveolens subsp. ***arabicum***, 198
Cordia, 69
Cordia crenata subsp. ***crenata***, 70
Cordia monoica, 69
Cordia myxa, 72
Cordia nevillii, 71
Cordia obliqua, 72
Cordia obovata, 69, 70
Cordia ovalis, 69
Cordia perrottetii, 71
Cordia quercifolia, 71
Cordia rothii, 71
Cordia sebestena, 72
Cordioideae, 68
Coreopsis biternata, 274
Cotula aurea, 253
Craterostigma, 147
Craterostigma pumilum, 147
Crenulluma adenensis, 25
Crenulluma arabica, 26
Crenulluma awdeliana, 30
Crenulluma flava, 27
Crenulluma kalmbachiana, 25
Crenulluma rauhii, 25
Crepis, 220
Crepis foetida, 221
Crepis kotschyana, 220
Crepis sp., 221, 228
Cressa, 52
Cressa cretica, 52
Crocyllis, 195
Cryptolluma edulis, 24
Cuscuta, 66
Cuscuta abyssinica, 67
Cuscuta arabica, 66
Cuscuta pedicellata, 66
Cuscuta planiflora, 67
Cuscuta planiflora var. *holstii*, 67
Cuscuta somaliensis, 67
Cuscutaceae, 66
Cyanthillium cinereum, 236
Cymbolaena, 242
Cymbolaena griffithii, 242
Cymbolaena longifolia, 242
Cynanchum, 20
Cynanchum gerrardii, 20
Cynanchum pyrotechnicum, 22
Cynanchum sarcostemmatoides, 20
Cynanchum tetrapterum, 20
Cynoctonum mitreola, 1
Cynoctonum petiolatum, 1
Cynoglossum intermedium, 89

D

Daemia cordata, 17
Daemia forskalii, 18

dalaween, 233
Datura, 44
Datura fastuosa, 44
Datura innoxia, 45
Datura metel, 44
dayfed, 165
defroegh, 124
degubsi, 34
dereg, 63
deri, 63
Desmidorchis, 24
Desmidorchis acutangula, 29
Desmidorchis adenensis, 25
Desmidorchis arabica, 26
Desmidorchis awdeliana, 30
Desmidorchis flava, 27
Desmidorchis impostor, 27
Desmidorchis lavranii, 31
Desmidorchis penicillata, 29
Desmidorchis quadrangula, 31
Desmidorchis tardellii, 28
Dianthera debile, 181
Dianthera odora, 181
Dianthera paniculata, 176
Dianthera violacea, 178
Dicliptera, 176
Dicliptera paniculata, 176
Dicoma, 208
Dicoma chatanensis, 209
Dicoma schimperi, 208
dij, 26, 27
Dipsacaceae, 200
Dipteracanthus longifolius, 166
Dodartia indica, 145
Doellia, 255
Doellia bovei, 255
Dracocephalum royleanum, 116
dugebos, 33, 34
duru el kebeh, 28
Dyschoriste, 165
Dyschoriste dalyi, 165
Dyssodia tenuiloba, 272

E

Echolium, 178
Echolium violaceum, 178
Echolium viride, 178
Echidnopsis, 33
Echidnopsis planiflora, 34
Echidnopsis quadrangula, 31
Echidnopsis scutellata, 33
subsp. ***dhofarensis***, 33
Echinops, 214
Echinops atrox, 215
Echinops erinaceus, 215
Echinospermum spinocarpos, 87
Echiochilon, 83
Echiochilon arabicum, 86
Echiochilon callianthum, 87
Echiochilon collenettei, 86
Echiochilon jugatum, 83
Echiochilon kotschyi, 84
Echiochilon longiflorum, 84
Echiochilon persicum, 85
Echiochilon strigosum, 85
Echiochilon thesigeri, 85
Eclipta, 276
Eclipta prostrata, 276
Egg plant, 48
Ehretia, 72
Ehretia aspera var. *obtusifolia*, 72
Ehretia dhofarica, 72
Ehretia obovata, 72
Ehretia obtusifolia, 72
Ehretiaceae, 67
Ehretioideae, 68
ekulen, 107
ekulun, 118
Endostemon, 123
Endostemon tenuiflorus, 123
Enicostema, 3
Enicostema axillare, 3
equwan-asfar, 241
erawiyan, 35
Erigeron, 249
Erigeron bonariensis, 250
Erigeron bovei, 255
Erigeron linifolius, 250
Erigeron pinnatifidus, 250
Erigeron strictus, 250
Erigeron trilobus, 250
Erythraea ramosissima, 4
esbed, 164
estah, 13
etebin, 49
Euryops, 236
Euryops arabicus, 236
Euryops pinifolius, 236
Euryops socotranus, 236
Exacum, 2
Exacum affine, 2
Exacum arabicum, 3
Exacum gracilipes, 2

F

fadakh, 58
fal, 265
farfar, 183
fazmae, 155
ferfar, 183
Filago, 243
Filago abyssinica, 244
Filago desertorum, 243
Filago pyramidata, 244
Filago vulgaris var. *abyssinica*, 244
Flaveria, 271
Flaveria repanda, 271
Flaveria trinervia, 271
folk, 11
Francoeuria crispa, 268

G

Gaillonia, 195
Gaillonia aucheri, 195
Gaillonia calycoptera, 196
Gaillonia hymenostephana, 197
Gaillonia yemenensis, 196
galawein, 233
Galium, 193
Galium aparine, 194
Galium ceratopodum, 193
Galium decaisnei, 193
Galium setaceum subsp. *decaisnei*, 193

Garhadiolus, 221
Garhadiolus angulosus, 221
Garhadiolus hedypnois, 221
Gastrocotyle, 94
Gastrocotyle hispida, 94
gathgeth, 268
gemrez, 106
genegeneh, 44
Gentiana axillaris, 3
Gentiana pulchella, 4
Gentianaceae, 1
Gerardia parviflora, 157
gesgas, 268
geygeh, 17
ghagha, 113
ghalaqah, 17
ghamradeh, 15
ghemrez, 15
gitaina, 243
Glossonema, 15
Glossonema arabicum, 15
Glossonema edule, 15
Glossonema varians, 15
Gnaphalium luteoalbum, 246
Gnaphalium muscoides, 247
godot, 260
Gomphocarpus, 16
Gomphocarpus fruticosus subsp. ***setosus***, 16
Gomphocarpus setosus, 16
Grantia aucheri, 256
Grantia discoidea, 256
Grantia flabellata, 256
Grantia senecionoides, 257
gunerain, 148
guniguned, 44
gunigunt, 44
Gymnarrhena micrantha, 278

H

haban, 10
hagaid, 231
halawla, 231
halbelib, 20
halbelob, 20
halmit, 83
hamhám, 228
hamshed, 96
hanga, 213
handabub, 12
hanqalan, 236
hanuwa, 241
hanwa, 241
haraq, 117
harmal, 9
hasaj, 247
hashishat el-jebal, 250
hashushat, 216
hasish al-faras, 255
hawa, 226, 233
hayqalan, 236
Hedyotis biflora, 190
Hedyotis pentandra, 190
Helichrysum, 245
Helichrysum glumaceum, 245
Helichrysum luteoalbum, 246
Helichrysum makranicum, 245
Helichrysum pumilum, 246
Helichrysum somalense, 246
Heliophytum pterocarpum, 78
Heliotropioideae, 68
Heliotropium, 74
Heliotropium bacciferum, 76
subsp. *lignosum*, 76
Heliotropium brevilimbe, 75
Heliotropium calcareum, 75
Heliotropium digynum, 81
Heliotropium drepanophyllum, 73
Heliotropium eichwaldii var. *lasiocarpum*, 80
Heliotropium ellipticum, 80
var. *lasiocarpum*, 80
Heliotropium europaeum, 80
var. *ellipticum*, 80
var. *lasiocarpum*, 80
var. *tenuiflorum*, 80
Heliotropium fartakense, 76
Heliotropium kotschyi, 76
Heliotropium lasiocarpum, 80
Heliotropium lignosum, 76
Heliotropium longiflorum, 74
Heliotropium makranikum, 75
Heliotropium multiflorum, 75
Heliotropium ophioglossum, 76
Heliotropium ovalifolium, 78
Heliotropium persicum, 76, 85
Heliotropium pterocarpum, 78
Heliotropium ramosissimum, 76
Heliotropium rariflorum, 79
Heliotropium strictum, 80
Heliotropium strigosum, 79
Heliotropium subspinosum, 80
Heliotropium tuberculosum, 76
Heliotropium undulatum, 76
var. *ramosissimum*, 76
helkem, 41
herum, 16
herum axali, 177
herum dezum, 97
heryen, 107
Heterachaena massavensis, 229
Heterocaryum, 87
Heterocaryum szovitsianum, 95
hilban, 119
hilben, 118, 119, 246
Hildebrandtia, 49
Hildebrandtia africana subsp. ***arabica*** , 49
hinaq, 215
hindibaa bareeya, 220
Hochstetteria schimperi, 208
hodem, 122, 123
howthan, 231
hudhan, 226
hukut, 41
huwah, 231
huwwa, 226
Hymenatherum tenuilobum, 272
Hyoscyamus, 46
Hyoscyamus datora, 46
Hyoscyamus flaccidus, 47
Hyoscyamus gallagheri, 47
Hyoscyamus insanus, 46
Hyoscyamus muticus, 46

Hypoestes, 176
Hypoestes forsskaolii, 177

I

Ifloga, 247
Ifloga spicata, 247
Inula arabica, 263
Inula divaricata, 259
Inula undulata, 268
Iphiona, 256
Iphiona aucheri, 256
Iphiona horrida, 256
Iphiona scabra, 257
var. *pinnatifida*, 257
Iphiona senecionoides, 257
Ipomoea, 60
Ipomoea aitonii, 64
Ipomoea aquatica, 63
Ipomoea arachnosperma, 64
Ipomoea biloba, 63
Ipomoea blepharosepala, 61
Ipomoea cairica, 64
Ipomoea dichroa, 64
Ipomoea eriocarpa, 61
Ipomoea hispida, 61
Ipomoea macalusoi, 65
Ipomoea nil, 61
Ipomoea obscura, 62
Ipomoea palmata, 64
Ipomoea pes-caprae, 63
Ipomoea punctata, 65
Ipomoea sinensis, 61
subsp. ***blepharosepala***, 61
Ipomoea tricolor, 65
Ipomoea turbinata, 65
isenu etirin, 16
Isoglossa punctata, 182
izbun, 246
izdot, 27, 28

J

ja'ada, 102, 103
Jasminum, 130
Jasminum floribundum, 130
Jasminum grandiflorum subsp. ***floribundum***, 130
jathjath, 268
Jaubertia, 195
Jaubertia aucheri, 195
Jaubertia calyoptera, 196
jid, 29
jithjath, 268
juljulaan, 182
Jurinea, 216
Jurinea berardioides, 216
Jurinea carduiformis, 217
jurrays, 210
Justicia, 179
Justicia areysiana, 179
Justicia bentii, 179
Justicia calyculata, 179
Justicia debilis, 181
Justicia diffusa, 180
Justicia forskaolii, 177
Justicia fruticulosa, 179
Justicia gangetica, 169
Justicia heterocarpa, 180
Justicia odora, 181
Justicia parviflora, 182
Justicia viridis, 178

K

kan'a, 215
kao, 72
kassoob, 213
kemerot, 61
keskas, 213
khabaath, 226
khas al waz, 233
khioach, 233
khoft, 270
khokhaoot, 265
khokhawoat, 265, 266, 267
khuwaysh, 233
kibb, 234, 236
Kickxia chasmophytica, 138
Kickxia heterophylla, 139
Kickxia qaraica, 140
Kickxia ramosissima, 138
kilkil, 12
Kleinia, 237
Kleinia butleri, 237
Kleinia lauchsii, 237
Kleinia mccoyi, 237
Kleinia odora, 238
Kleinia pendula, 239
Kleinia saginata, 238
Kleinia squarrosa, 239
Koelpinia, 221
Koelpinia linearis, 222
Kohautia, 191
Kohautia caespitosa, 191
Kohautia retrorsa, 191
Kuhnia arabica, 259
kumun, 199

L

Lactuca, 222
Lactuca capensis, 223
Lactuca crassifolia, 227
Lactuca dissecta, 222
Lactuca inermis, 223
Lactuca intybacea, 228
Lactuca orientalis, 223
Lactuca yemensis, 223
Laggera aurita, 262
lahiat al tais, 222
Lallemantia, 115
Lallemantia royleana, 116
Lamiaceae, 100
Lantana, 97
Lantana petitiana, 98
Lantana rhodesiensis, 98
Lantana rugosa, 98
Lantana salviifolia, 98
Lantana viburnoides, 97
Lappula, 87
Lappula spinocarpos, 87
Lasiopogon, 247
Lasiopogon muscoides, 247
Lathraea phelypaea, 158
Launaea, 224
Launaea almahrahensis, 225
Launaea bornmuelleri, 226
Launaea capitata, 226
Launaea cassiniana, 230

Launaea castanosperma, 227
Launaea crassifolia, 227
Launaea glomerata, 226
Launaea hafunensis, 228
Launaea intybacea, 228
Launaea massavensis, 229
Launaea mucronata, 229
subsp. ***cassiniana***, 230
subsp. ***mucronata***, 230
Launaea omanensis, 230
Launaea procumbens, 231
Launaea remotiflora, 228
Launaea spinosa, 226
Lavandula, 116
Lavandula bipinnata forma *subnuda*, 117
Lavandula dhofarensis, 118
subsp. ***ayuensis***, 118
subsp. ***dhofarensis***, 118
Lavandula hasikensis, 119
Lavandula macra, 117
Lavandula samhanensis, 119
Lavandula subnuda, 117
lema, 218
Lentibulariaceae, 184
Leontodon mucronatus, 229
Lepidagathis, 174
Lepidagathis calycina, 174
Leptadenia, 21
Leptadenia pyrotechnica, 22
Leptadenia visciformis, 12
Leptorhabdos, 157
Leptorhabdos parviflora, 157
Leucas, 106
Leucas dhofarensis, 107
Leucas inflata, 106
Leucas urticifolia, 106
Leucobarleria robecchii, 175
Linaria, 140
Linaria hastata, 139
Linaria ramosissima, 138
Linaria simplex, 140
Lindenbergia, 145
Lindenbergia arabica, 146
Lindenbergia indica, 145
Lindenbergia muraria, 146
Linderbergia fruticosa, 145
lisan al kalb, 129
Lithospermum ciliatum, 82
Lithospermum dispermum, 88
Lithospermum hispidissimum, 90
Lithospermum kotschyi, 84
Lobelia, 188
Lobelia heyneana, 188
Lobeliaceae, 186
Loganiaceae, 1
Lonicera, 199
Lonicera aucheri, 199
Lonicera aurea, 199
Lonicera hypoleuca, 199
lqat, 263
Lycium, 38
Lycium arabicum, 38
Lycium persicum, 38
Lycium shawii, 38
Lycopersicon esculentum, 48
Lysimachia monnieri, 147

M

Madorius procerus, 15
maknan, 231
maranhah, 44
markh, 22
Mastostigma varians, 15
Matricaria, 253
Matricaria aurea, 253
Megalochlamys, 178
Megalochlamys violacea, 178
Megastoma, 82
Megastoma pusillum, 82
mejoj, 44
Mentha, 113
Mentha longifolia, 113
Mentha spicata var. *longifolia*, 113
Mentha sylvestris, 113
merare, 214
Merremia, 59
Merremia dissecta, 60
Merremia somalensis, 59
Micromeria, 114
Micromeria biflora, 114
Micromeria imbricata, 114
Microparacaryum intermedium, 89
Micropus longifolius, 242
Microrhynchus glomeratus, 226
Misopates, 137
Misopates orontium, 137
mithidi, 265
Mitreola, 1
Mitreola petiolata, 1
Moltkiopsis, 82
Moltkiopsis ciliata, 82
Moluccella persica, 105
Monechma debile, 181
Monk's pepper, 126
Monolluma, 31
Monolluma hexagona, 32
Monolluma quadrangula, 31
moraar, 231
morrar, 231
mughelif, 177
muhayda, 265
mulawwiya, 58
mulizqa, 193
murair, 240
murrar, 213
muthadi, 265
mutranee, 231

N

na'ana, 113
Nanorrhinum, 138
Nanorrhinum hastatum, 139
Nanorrhinum heterophyllum, 139
Nanorrhinum ramosissimum, 138, 139
nedewah, 52
Neogaillonia, 195
Neogaillonia aucheri, 195
Neogaillonia calycoptera, 196
Neogaillonia hymenostephana, 197

Nerium mascatense, 10
Nerium obesum, 8
Nerium odorum, 10
Nerium oleander, 10
Neuracanthus, 175
Neuracanthus robecchii, 175
subsp. ***atratus***, 175
Neuracanthus spinosus, 175
Nicandra, 45
Nicandra physalodes, 45
Nicotiana tabacum, 48
Nidorella punctulata, 251
Nidorella stricta, 250
Nidorella triloba, 250
nigely, 163
nigeyl, 163
Nogalia, 73
Nogalia drepanophyllum subsp. ***drepanophyllum***, 73
Notobasis, 217
Notobasis syriaca, 217

O

Ocimum, 120
Ocimum basilicum, 120
Ocimum dhofarense, 122
Ocimum forskolei, 121
Ocimum hadiense, 121
Ocimum menthiifolium, 121
Ocimum reflexum, 122
odeid, 233
Odera trinervia, 271
Odontospermum pygmaeum, 258
Ogastemma, 82
Ogastemma pusillum, 82
Oldenlandia, 189
Oldenlandia biflora, 190
Oldenlandia corymbosa, 189
var. ***caespitosa***, 190
var. ***corymbosa***, 190
Oldenlandia retrorsa, 191
Olea, 131
Olea africana, 131
Olea aucheri, 131
Olea chrysophylla, 131
var. *aucheri*, 131
Olea cuspidata, 131
Olea europaea, 131
subsp. *africana*, 131
subsp. ***cuspidata***, 131
var. *cuspidata*, 131
Olea somaliensis, 131
Oleaceae, 130
Omania, 145
Omania arabica, 146
o'qhowan, 252
Orbea, 35
Orbea luntii, 36
Orbea nardii, 35
Orbea parviloba, 35
Orbea wissmannii var. *parviloba*, 35
Orbivestus cinerascens, 235
Orobanchaceae, 157
Orobanche, 159
Orobanche cernua, 161
Orobanche dhofarensis, 161
Orobanche perangustata, 160
Orobanche ramosa, 159
Orobanche tinctoria, 158
Orthosiphon, 122
Orthosiphon comosus, 122
Orthosiphon pallidus, 122
Orthosiphon reflexus var. *pallidus*, 122
Orthosiphon temuiflorus, 123
oshar, 15
oshur, 15
Osteospermum vaillantii, 241
Otostegia kotschyi, 105
Otostegia microphylla, 105
Otostegia persica, 105
Outreya carduiformis, 217
Oxystelma esculentum, 37

P

Pachycymbium, 35
Pachycymbium luntii, 36
Pallenis, 258
Pallenis hierichuntica, 258
Paracaryum, 89
Paracaryum caelestinum, 90
Paracaryum intermedium, 89
Parthenium, 276
Parthenium hysterophorus, 276
Pavetta, 197
Pavetta arabica, 197
Pavetta deflersii, 197
Pavetta longiflora, 197
Pedaliaceae, 182
Peganum harmala, 9
Pegolettia, 259
Pegolettia senegalensis, 259
Pentanema, 259
Pentanema divaricatum, 259
Pentatropis, 18
Pentatropis bentii, 19
Pentatropis nivalis, 19
Pentodon, 190
Pentodon pentandrus, 190
var. ***pentandrus***, 190
Pergularia, 17
Pergularia daemia, 18
Pergularia tomentosa, 17
Periploca, 12
Periploca aphylla, 12
Periploca esculenta, 37
Periploca visciformis, 12
Periplocoideae, 12
Peristrophe paniculata, 176
Phaenopus orientalis, 223
Phagnalon, 248
Phagnalon androssovii, 248
Phagnalon arabicum, 260
Phagnalon schweinfurthii, 248
var. *androssovii*, 248
Phagnalon viridifolium, 248
var. *omanense*, 248
Phelypaea tubulosa, 158
Phlomis urticifolia, 106
Phyla, 97
Phyla nodiflora, 97
Physalis, 42
Physalis angulata, 43
Physalis minima, 43

Physalis somnifera, 43
Physoleucas inflata, 106
Plantaginaceae, 127
Plantago, 127
Plantago albicans, 128
Plantago amplexicaulis, 127
Plantago boissieri, 128
Plantago ciliata, 129
Plantago major, 129
Plantago ovata var. ***ovata***, 128
Plectranthus, 124
Plectranthus barbatus, 124
Plectranthus cylindraceus, 125
Plectranthus hadiensis, 121
Plectranthus marrubioides, 125
Plectranthus montanus, 125
Plocama, 195
Plocama aucheri, 195
Plocama calycoptera, 196
Plocama hymenostephana, 197
Plocama yemenensis, 196
Pluchea, 260
Pluchea arabica, 260
Pluchea dioscoridis, 261
Pluchea laxa, 260
Pluchea mollis, 261
Pluchea multiflora, 260
Pluchea ovalis, 261
Plumeria rubra, 11
Premna, 125
Premna resinosa, 125
Prenanthes procumbens, 231
Priva, 96
Priva adhaerens, 96
Priva cordifolia, 96
Pseudoconyza, 262
Pseudoconyza viscosa, 262
Pseudogaillonia, 195
Pseudogaillonia hymenostephana, 197
Pseudognaphalium luteoalbum, 246
Pseudolithos dodsonianus, 35
Pseudolithos mccoyi, 34
Psiadia, 251
Psiadia arabica, 251
Psiadia punctulata, 251
Pterochaeta glutinosa, 265
Pterogaillonia, 195
Pterogaillonia calycoptera, 196
Pulicaria, 262
Pulicaria arabica, 263
subsp. *inuloides*, 263
Pulicaria argyrophylla
subsp. ***oligophylla***, 264
var. *oligophylla*, 264
Pulicaria crispa, 268
Pulicaria cylindrica, 265
Pulicaria edmondsonii, 264
Pulicaria gamal-eldiniae, 269
Pulicaria glutinosa, 265
Pulicaria hadramautica, 266
Pulicaria inuloides, 263
Pulicaria jaubertii, 265
Pulicaria longifolia, 263
Pulicaria nobilis, 266
Pulicaria omanensis, 266
subsp. *milleri*, 266
Pulicaria orientalis, 265
Pulicaria pulvinata, 267
Pulicaria rauhii, 266
Pulicaria samhanensis, 267
Pulicaria schimperi, 268
Pulicaria undulata, subsp. ***undulata***, 268
Pyrostria phyllanthoides, 198

Q

qan'a, 215
qasad, 38
qishqish, 226
qisummat al wa'al, 105
qorreis, 240
qotnya, 107
quottainah, 243
qurm, 99

R

ra'al, 108
Rajisthan teak, 183
ram ram, 76
Raphionacme, 13
Raphionacme arabica, 13
rayan, 33
re wiyon, 35
rehan, 120, 121
Reichardia, 231
Reichardia arabica, 231
Reichardia orientalis, 231
Reichardia tingitana, 231
var. *arabica*, 231
rejet al ghurab, 240
Rhabdotosperma, 141
Rhagadiolus angulosus, 221
Rhanterium, 269
Rhanterium epapposum, 269
Rhazya, 9
Rhazya stricta, 9
Rhytidocaulon, 33
Rhytidocaulon fulleri, 33
Rochelia, 88
Rochelia disperma, 88
Rubia, 192
Rubia infundibularis, 192
Rubiaceae, 188
Ruellia, 166
Ruellia adhaerens, 96
Ruellia carnea, 168
Ruellia ciliaris, 163
Ruellia discifolia, 168
Ruellia longifolia, 166
Ruellia patula, 167
Ruellia prostrata, 167
Ruellia sindica, 166
Ruelloideae, 162
rum ram, 76
Rungia parviflora, 182
Ruttya, 177
Ruttya fruticosa, 177
Rydingia, 105
Rydingia persica, 105

S

sabounat el'afrit, 246
sabt, 268

sahikee, 261
sakaran, 46
salaykit, 191
salis, 233
Salvia, 107
Salvia aegyptiaca, 108
Salvia hillcoatiae, 111
Salvia kotschyi, 110
Salvia macilenta, 109
Salvia macrosiphon, 110
var. *kotschyi*, 110
Salvia mirzayanii, 111
Salvia santolinifolia, 109
Salvia sp. ***A***, 112
Sarcocyphula gerrardii, 20
Sarcostemma, 20
Sarcostemma stipitaceum, 21
Sarcostemma viminale, 21
subsp. ***stipitaceum***, 21
Satureja imbricata, 114
Saulcya hierichuntica, 258
sawma, 121
sawmar, 117
Scabiosa, 200
Scabiosa olivieri, 200
Sceura marina, 99
schwayla, 52
Schweinfurthia, 134
Schweinfurthia imbricata, 135
Schweinfurthia latifolia, 136
Schweinfurthia papilionacea, 134
Schweinfurthia pedicellata, 137
Schweinfurthia pterosperma, 136
var. *latifolia*, 136
Schweinfurthia spinosa, 135
Sclerocarpus, 277
Sclerocarpus africanus, 277
Sclerocaryopsis spinocarpos, 87
Scopolia mutica, 46
Scorzonera tingitana, 231
Scorzonera tortuosissima, 278
Scrophularia, 143
Scrophularia arguta, 143
Scrophularia desertii, 144
Scrophulariaceae, 132
sebbin, 164
sebhit, 125
sebkheedh, 69
sedah istah, 13
Seddera, 50
Seddera glomerata subsp. ***dhofarensis***., 50
Seddera latifolia, 51
Seddera retusa, 52
Seddera velutina, 51
sefot, 14
seman, 62
semkis, 38
semkos, 38
Senecio, 239
Senecio breviflorus, 239
Senecio coronopifolius, 240
Senecio desfontainei, 240
Senecio flavus subsp. *breviflorus*, 239
Senecio glaucus subsp. ***coronopifolius***, 240
Senecio mohavensis subsp. *breviflorus*, 239
senin, 62
senkot, 38
serayn, 31
sereyon, 31
Sericostoma persicum, 85
Sericostoma strigosa, 85
Seriphidium sieberi, 252
sesame, 182
Sesamum, 182
Sesamum indicum, 182
seyfid, 8
seyfod, 14
shabah-al-jamal, 211
shajarat al babaw, 208
shajarat al balbul, 245
shajarat al ghubrah, 53
shajarat al jalud, 17
shakhees, 240
sharinjiban, 41
shawk al gamal, 215
shawrana, 212
shejarat al gharub, 39
shih, 252
shjarat al m'aza, 247
shohit, 125
shoo fly, 45
sif sif, 98
silka, 191
silli, 83
simsim, 182
siot, 123, 234
skelwan, 19
Socotora aphylla, 12
Socotora visciformis, 12
Solanaceae, 37
Solanum, 39
Solanum coagulans, 41
Solanum cordatum, 40
Solanum dubium, 41
Solanum humile, 40
Solanum incanum, 41
Solanum lycopersicon, 48
Solanum melongena, 48
Solanum miniatum, 40
Solanum nigrum, 39
subsp. ***nigrum***, 39
var. *humile*, 40
Solanum surattense, 42
Solanum tuberosum, 48
Solanum villosum, 40
subsp. ***miniatum***, 40
Solanum virginianum, 42
Solanum xanthocarpum, 42
Somalia, 170
Somalia diffusa, 171
Sonchus, 232
Sonchus asper, 233
Sonchus maritimus, 232
Sonchus oleraceus, 233
soudoud, 169
Spathodea campanulata, 184
Spermacoce calycoptera, 196
Stapelia quadrangula, 31
Stemodia muraria, 146
Stictocardia, 65
Stictocardia macalusoi, 65

Stictocardia tiliifolia subsp. *macalusoi*, 65
Striga, 154
Striga angustifolia, 155
Striga asiatica, 156
Striga densiflora, 155
Striga gesnerioides, 154
Strobopetalum bentii, 19
Strychnos nux-vomica, 1
Stylocline griffithii, 242
sufeira, 239
Sulcolluma hexagona, 32
sutah, 13
Svensonia, 95

T

tabagh, 48
Tagetes, 272
Tagetes erecta, 272
talsayf, 265
tamatum, 48
tarabah, 247
Tarenna graveolens subsp. *arabica*, 198
tebaq, 250
Tecoma alata, 184
Tecoma stans, 184
Tecoma undulata, 183
Tecomella, 183
Tecomella undulata, 183
teqelum, 15
Teraedrocarpus arabicus, 86
Teucrium, 101
Teucrium mascatense, 102
Teucrium nummularifolium, 103
Teucrium paulayanum, 103
Teucrium stocksianum, 102
subsp. ***stenophyllum***, 103
subsp. ***stocksianum***, 102
Teucrium yemense, 104
thal, 265
Thevetia peruviana, 11
thorn apple, 44
Thymophylla, 272
Thymophylla tenuiloba, 272
Thymus imbricatus, 114
tobacco, 48
tomato, 48
Tragopogon picroides, 233
Tribe Anthemideae, 251
Tribe Astereae, 249
Tribe Athroismeae, 270
Tribe Barlerieae, 162
Tribe Calenduleae, 241
Tribe Cardueae, 209
Tribe Cichorieae, 219
Tribe Coreopsideae, 274
Tribe Dicomeae, 208
Tribe Eupatorieae, 271
Tribe Gnaphalieae, 242
Tribe Heliantheae, 275
Tribe Inuleae, 254
Tribe Justicieae, 162
Tribe Millerieae, 273
Tribe Ruellieae, 162
Tribe Senecioneae, 236
Tribe Tageteae, 271
Tribe Vernonieae, 234
Trichodesma, 91
Trichodesma africanum, 91
var. *ehrenbergii*, 92
Trichodesma arabicum, 93
Trichodesma bentii, 92
Trichodesma cardiosepalum, 93
Trichodesma cinereum, 93
Trichodesma dhofaricum, 93
Trichodesma ehrenbergii, 92
Trichodesma enetotrichum, 92
Trichodesma hildebrandtii, 93
Trichodesma laecophilum, 93
Tridax procumbens, 277
Tripteris, 241
Tripteris vaillantii, 241
Tubilium angustifolium, 263
tur iyyel, 177

U

uddaidha, 233
ufaynah, 259
umm drus, 210
urayfijan, 268
Urbania lyperiiflorum, 144
Urospermum, 233
Urospermum picroides, 233
usfur, 212
ushar, 15
Utricularia, 184
Utricularia australis, 184
Utricularia orbiculata, 185
Utricularia striatula, 185

V

Valantia, 194
Valantia cucullaris, 192
Valantia hispida, 194
Valerianella discoidea, 199
Valerianella szovitsiana, 200
Varthemia arabica, 260
Verbascum, 141
Verbascum akdarense, 143
Verbascum cedreti, 141
Verbascum omanense, 142
Verbascum sinaiticum, 141
Verbena forskalaei, 96
Verbena nodiflorum, 97
Verbenaceae, 95
Verbesina acmella, 275
Verbesina alba, 276
Verbesina dichotoma, 275
Verbesina prostrata, 276
Vernonia, 234
Vernonia arabica, 234
Vernonia atriplicifolia, 234
Vernonia cinerascens, 235
Vernonia cinerea, 236
Veronica, 152
Veronica anagallis-aquatica subsp. *anagalloides*, 152
Veronica anagalloides subsp. ***anagalloides***, 152
Veronica didyma, 153
Veronica haussknechtii, 152
Veronica polita, 153
Vicoa pentanema, 259

Vitex, 126
Vitex agnus-castus, 126
Volutaria, 218
Volutaria dhofarica, 218
Volutaria leucantha, 218
Volutaria lippii, 218
Volutaria sinaica, 218

W

Wahlenbergia, 186
Wahlenbergia flexuosa, 186
Withania, 43
Withania quaritica, 44
Withania somnifera, 43
var. *communis*, 43

X

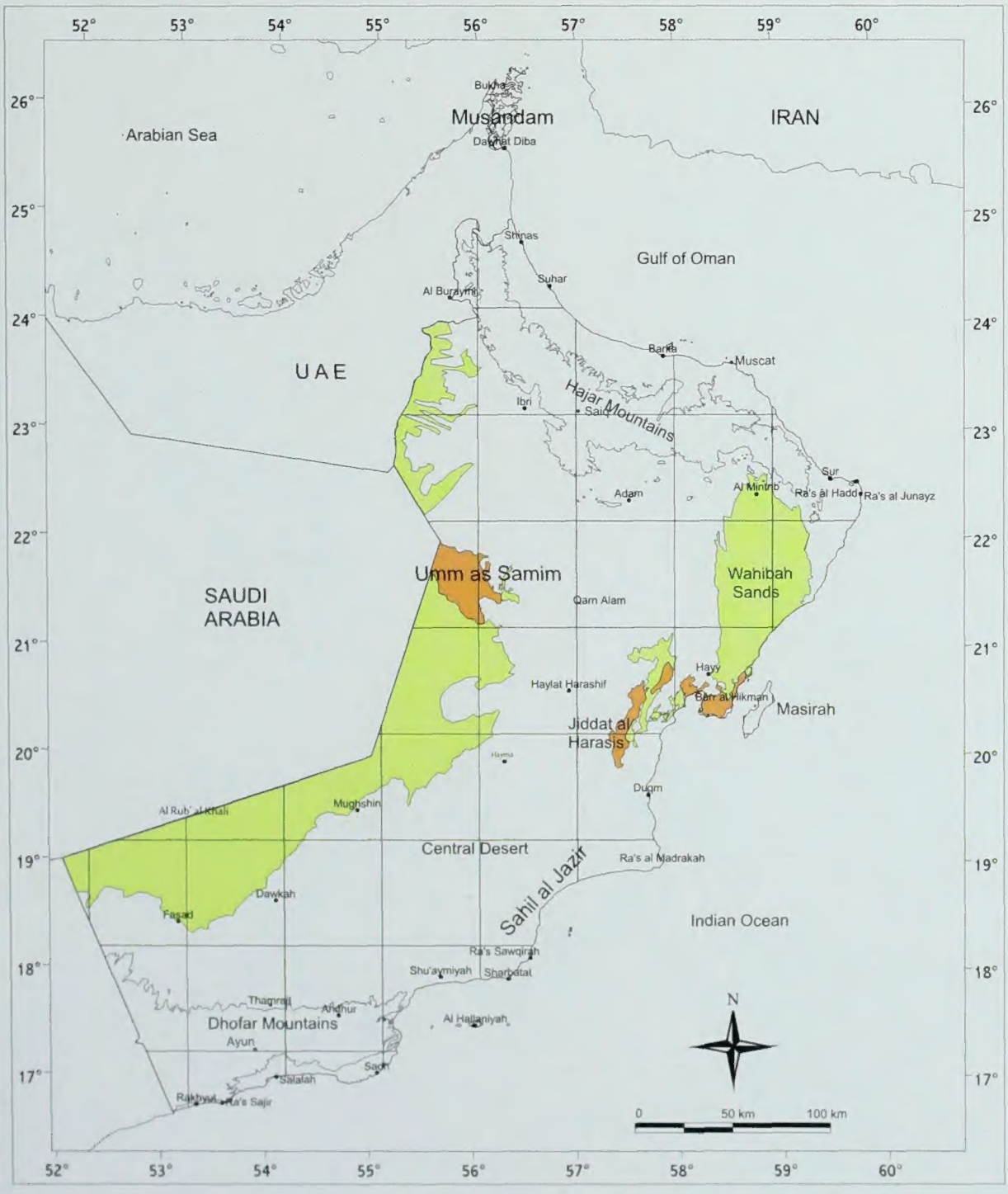
Xanthium strumarium, 277

Y

yasmeen, 130
yilbeen, 234

Z

zafaran, 212
zaghaf, 47
zamlooq, 240
Zataria, 113
Zataria multiflora, 114
zefubrek, 124
zere, 63
zgaf, 47
zifed, 165
Ziziphora, 115
Ziziphora tenuior, 115
Zoegea, 219
Zoegea purpurea, 219
zoja, 27, 28, 31
Zollikoferia bornmuelleri, 226
Zollikoferia glomerata, 226
zunaymah, 247



Physical features and main locations of the Sultanate of Oman. Contours of the Hajar, Dhofar and Musandam mountains at 500 m; deep sand and sabkha coloured yellow and orange respectively.

Inside

Interactive CD-ROM with colour photographs
and Index of vernacular names

Map of the main locations of the Sultanate of Oman

Scripta Botanica Belgica 55

S.A. Ghazanfar

FLORA OF THE SULTANATE OF OMAN

Volume 3

Loganiaceae – Asteraceae

The third volume of the *Flora of the Sultanate of Oman* is the final one of the three volumes dealing with dicotyledons. It includes 23 families and 376 taxa following Cronquist's (1981) system with explanatory notes where the APG III (2009) classification or recent molecular evidence treats the families or genera differently. This volume includes the Subclass Asteridae with the Oman flora represented in nine Orders: Gentianales, Solanales, Lamiales, Plantaginales, Scrophulariales, Campanulales, Rubiales, Dipsacales and Asterales. For each family keys are provided to all genera and species. Species descriptions are accompanied with notes on distribution, habitat, flowering and fruiting times, conservation status, and uses where relevant. Distribution maps are provided for all described species. The accompanying CD-ROM includes photographs of most species included in this volume.

Shahina A. Ghazanfar has lived, worked and travelled in Oman, Pakistan and Nigeria, and has made major contributions to the study of the vegetation and floras of these countries. She has special interest in arid and saline environments, and their conservation, in particular that of Arabia. Her interest extends to traditional medicine and plants of economic importance of Arabia and SW Asia. Shahina Ghazanfar studied at the University of Punjab, Pakistan, and at the University of Cambridge, UK, and is currently working at the Royal Botanic Gardens at Kew, UK.

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